METEOR-Berichte

Oxygen in the Tropical Atlantic Ventilation, Respiration, and Overturning Circulation

Cruise No. M106

April 19 – May 26, 2014

Mindelo (Cape Verde) – Fortaleza (Brazil)

P. Brandt

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1 Summary

R/V METEOR cruise M106 was a joint effort of the Kiel Collaborative Research Centre SFB 754 ("Climate - Biogeochemistry Interactions in the Tropical Ocean“) involving the BMBF joint projects RACE and SOPRAN as well as of the German-French-African Cooperative Project AWA. The main goal within the framework of the SFB 754 was the quantification of oxygen supply to the oxygen minimum zone (OMZ) of the Eastern Tropical North Atlantic (ETNA). Ventilation processes to be investigated include lateral and vertical mixing and oxygen advection (SP A3 and A4). The role of zooplankton and particles for oxygen consumption and biogeochemical cycles (SP B8) was another focus of this cruise. All planned hydrographic and current data were acquired as planned, including the successful recovery of all moorings with an above-average data gain. At the equator, the cruise additionally focussed on the equatorial current system, its interannual to decadal variability and its role in the zonal transport of heat, freshwater, and oxygen (BMBF RACE, SFB 754). The long-term mooring at the equator, at 23°W was successfully recovered and redeployed. At the western boundary of the South Atlantic off Brazil, a special focus was placed on the transport variability of the North Brazil Undercurrent (NBUC) and the Deep Western Boundary Current (DWBC) – as part of the meridional overturning circulation (AMOC) – on timescales from intraseasonal to decadal. The mooring array at 11°S at the shelf and continental slope off the Brazilian coast, deployed in July 2013, was successfully recovered and redeployed. The boundary current system was surveyed with two high-resolution hydrographic sections (CTD/LADCP, shipboard ADCP) at 5°S and 11°S off Brazil.

Zusammenfassung

Die wissenschaftlichen Arbeiten auf dem Fahrtabschnitt M106 sind Teil des SFB 754, der BMBF Verbundprojekte RACE und SOPRAN, sowie des deutsch-französisch-afrikanischen Verbundprojekts AWA. Hauptziel von M106 im Rahmen des SFB754 war die Quantifizierung der Sauerstoffzufuhr zur Sauerstoffminimumzone (OMZ) des tropischen Nordostatlantiks. Die zu untersuchenden Ventilationsprozesse beinhalten laterale und diapyknische Vermischung sowie Sauerstoffadvektion (SP A3 und A4). Die Rolle von Zooplankton und Teilchen für den Sauerstoffverbrauch und biogeochemische Zyklen war ein weiterer Schwerpunkt der Reise (SP B8). Alle geplanten hydrografischen und Strömungsmessungen konnten wie geplant durchgeführt werden. Das schließt insbesondere die erfolgreiche Aufnahme aller Verankerungen mit einem überdurchschnittlichen Datengewinn mit ein. Am Äquator konzentrierten sich die Arbeiten zusätzlich auf das äquatoriale Stromsystem, auf seine zwischenjährlichen bis dekadischen Schwankungen (mit Hilfe von Langzeitverankerungen) und auf seine Rolle für den zonalen Transport von Wärme, Frischwasser und Sauerstoff (BMBF RACE, SFB754). Die Langzeitverankerung am Äquator bei 23°W konnte erfolgreich geborgen und wieder ausgelegt werden. Am westlichen Rand des Südatlantiks vor Brasilien konzentrierten sich die Arbeiten auf Transportschwankungen des Nordbrasilunterstroms (NBUC) und des tiefen westlichen Randstroms (DWBC) - als Teil der meridionalen Umwälzbewegung (AMOC) - auf intrasaisonalen bis dekadischen Zeitskalen. Das Verankerungsarray bei 11°S am Schelf und Kontinentalabhang vor Brasilien, das im Juli 2013 während M98 ausgelegt wurde, konnte erfolgreich geborgen und wieder ausgelegt werden.

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MPIM Max Planck Institute for Meteorology, Bundesstrasse 53, 20146 Hamburg, Germany

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3 Research Program

The research program of R/V METEOR cruise 106 (M106) consisted of hydrographic and current observations to study tropical circulation, water mass pathways, ventilation of the eastern tropical North Atlantic (ETNA) oxygen minimum zone (OMZ) along the 23°W meridian between the Cape Verdean islands (about 15°N) and 8°30'S and along the 11°S and 5°S sections off Brazil. This program was accompanied by a dedicated study of the zooplankton ecophysiology and particle distribution. Several long-term moorings were replaced during the cruise that are aimed at the study of biogeochemical cycles (CVOO), oxygen variability and supply (11°N, 5°N), the variability of the equatorial current system (equator), and the variability of the western boundary current system (11°S). Station work along the 23°W, 11°S, and 5°S sections included measurements with a CTD/Lowered ADCP/Underwater Vision Profiler (UVP), a microstructure probe and a zooplankton multinet. In addition, underway measurements of currents with the two shipboard ADCPs and hydrographic measurements with thermosalinograph, optode, $p\mathrm{CO_2}$ sensor and gas tension device (GTD) were performed. Incubation experiments for estimating N_2 fixation and primary productivity and N_2O measurements for estimating production pathways were carried out.

4 Narrative of the Cruise

(Peter Brandt)

R/V METEOR departed from Mindelo on April 19, 2014 at 9:00 and headed north between the Cape Verdean islands of São Vicente and Santo Antão. The recovery of a glider that was part of a glider swarm experiment north, east, and south of the Cape Verde archipelago was the first activity of the cruise. All gliders to be recovered during M106 were deployed during the previous cruise M105 with chief scientist Martin Visbeck. The successful recovery of the CVOO (Cape Verde Ocean Observatory) mooring north of São Vicente was followed by several CTD-O_2/Lowered ADCP/UVP stations which were used for water sampling of oxygen, dissolved inorganic carbon and total alkalinity (DIC/TA), nutrients, chlorophyll-*a* (Chl-*a*) and salinity. Furthermore zooplankton multinet stations during day and night, and microstructure measurements were conducted. Some of the CTD/O_2 stations were also used to calibrate different moored instruments, including MicroCATs, optodes and Mini-TD (temperature, depth) loggers. These instruments were either just recovered or to be deployed in the afternoon of April 20, when the CVOO mooring was successfully redeployed.

On April 21 at 15:50, the second glider was recovered south of the Cape Verdean island of Maio. This glider - together with another French glider was part of the German-French Cooperative Project AWA - observed hydrographic properties in the eastern boundary upwelling region along the zonal 14°30'N section between Senegal and Cape Verde.

The measurements along 23°W, including 75 CTD-O_2/LADCP/UVP stations between 15°N and 8°30'S, were a main focus of our cruise. The work along this section started on April 15 and ended on May 10. The spatial resolution of CTD station work was 30' in latitude north of 4°N and south of 4°S, 20' in latitude between 4°N and 4°S with some additional CTD-O_2/LADCP/UVP stations near the equator. Most of the stations were performed down to the bottom; few were used for additional water sampling for nitrogen fixation experiments or for moored instrument calibration. Additional zooplankton multinet stations were performed every 2° in latitude, with some higher resolution near the equator.

On April 24 and 25, we departed from the 23°W section to recover and redeploy the SFB754 mooring at 21°13'W, 11°02'N which corresponds approximately to the centre of the OMZ. The mooring was equipped with a series of oxygen, temperature and salinity sensors as well as a 75 kHz Longranger (LR) ADCP for velocity measurements in the upper 800 m. At this location we also recovered the third glider that measured spatial variability of hydrographic properties around the mooring to be combined in the future analysis with the temporal variability observed with the moored instruments. At this location, the OSTRE (Oxygen Supply Tracer Release Experiment) was carried out in November 2012, and the tracer distribution was surveyed during M105. Another glider was later recovered near 23°W, 6°N. This glider, additionally equipped with a microstructure probe, first conducted profiling operations around the mooring position 21°13'W, 11°02'N. Thereafter, a southward transect across the abyssal plain region and a region with a number of seamounts was conducted to measure regional differences in the diapycnal mixing.

On April 28, we arrived at the mooring array at 4.5-5°N composed of three moorings in a triangular configuration. The moorings were equipped with a series of oxygen, temperature and salinity sensors as well as LR ADCPs. All three moorings were recovered successfully in three successive days, yielding almost complete datasets. Only one mooring, at 23°W, 5°N, was redeployed to continue observations of long-term variability at the southern rim of the OMZ.

On May 3, the equatorial mooring was recovered and redeployed the next day. This mooring, deployed in cooperation with the international PIRATA program, is aimed at observing the equatorial current system. This includes the eastward flowing Equatorial Undercurrent in the upper 200m with a core depth of about 80m, and the westward flowing Equatorial Intermediate Current below the EUC and the Equatorial Deep Jets (EDJ). The recovered mooring was equipped with two ADCPs for the near surface and intermediate flow above 800m, with few single-point current meters, oxygen, temperature and salinity sensors, and with a moored profiler (for velocity, oxygen, temperature and salinity measurements) climbing the mooring wire up and down every four days between 3500 and 1000m water depth. All instruments worked well. Even the moored profiler, which experienced some failures during previous mooring periods, worked throughout the entire mooring period, with some degradation in the profiling range toward the end of the mooring period. At the equator, few CTD-O_2/LADCP/UVP stations were repeated to confirm the large marine snowfall of particles right at the equator as observed with the UVP. In comparison to similar measurements during MSM22 in November 2012, we again observed a curtain of small particles (0.06 – 0.25 mm ESD) from 2°N to 2°S that extended from the sea surface to the seafloor at 3000 to 5000 m depth. The abundance of larger particles (0.25 – 1.50 mm ESD), however, was different in May 2014 compared to November 2012. A marine snowfall of large particles was mainly observed directly after the upwelling season in November 2012, but was not present in May 2014 (before the equatorial upwelling season).

After completion of measurements along 23°W on May 10, R/V METEOR headed southwest towards the western boundary off Brazil. After the transit to the next working area, the CTD-O_2/LADCP/UVP station and mooring work along 11°S commenced on May 12, 2014. Along this section, 4 current meter moorings were recovered and redeployed, and two PIES (inverted echo sounder with pressure sensor) with separate acoustic modems for data transmission were deployed. With the deployment of the fourth mooring off Brazil on May 17, the mooring work during M106 ended very successfully: all moorings were recovered, and mooring deployments went very smoothly without problems. In between and following the mooring work, a total of 22 surface-to-bottom CTD-O_2/LADCP/UVP stations and 16 microstructure stations with acquisition of typically 3 profiles per station were carried out. Some CTD stations were again used for moored instrument calibration. Water samples were taken for calibration of salinity and oxygen sensors of the CTD system as well as for incubation experiments for nitrogen fixation studies. The CTD section was finished on May 19, 2014 and R/V METEOR thereafter headed northeast towards the easternmost station of the 5°S section.

Along the last section of the cruise along about 5°S, a total of 17 surface-to-bottom CTD-O_2/LADCP/UVP stations and 13 microstructure stations with acquisition of typically 3 profiles per station were carried out. The section was finished on May 24.

The ship arrived at the port of Fortaleza, Brazil on May 26, 2014 at 8:00 (Fig. 4.1).

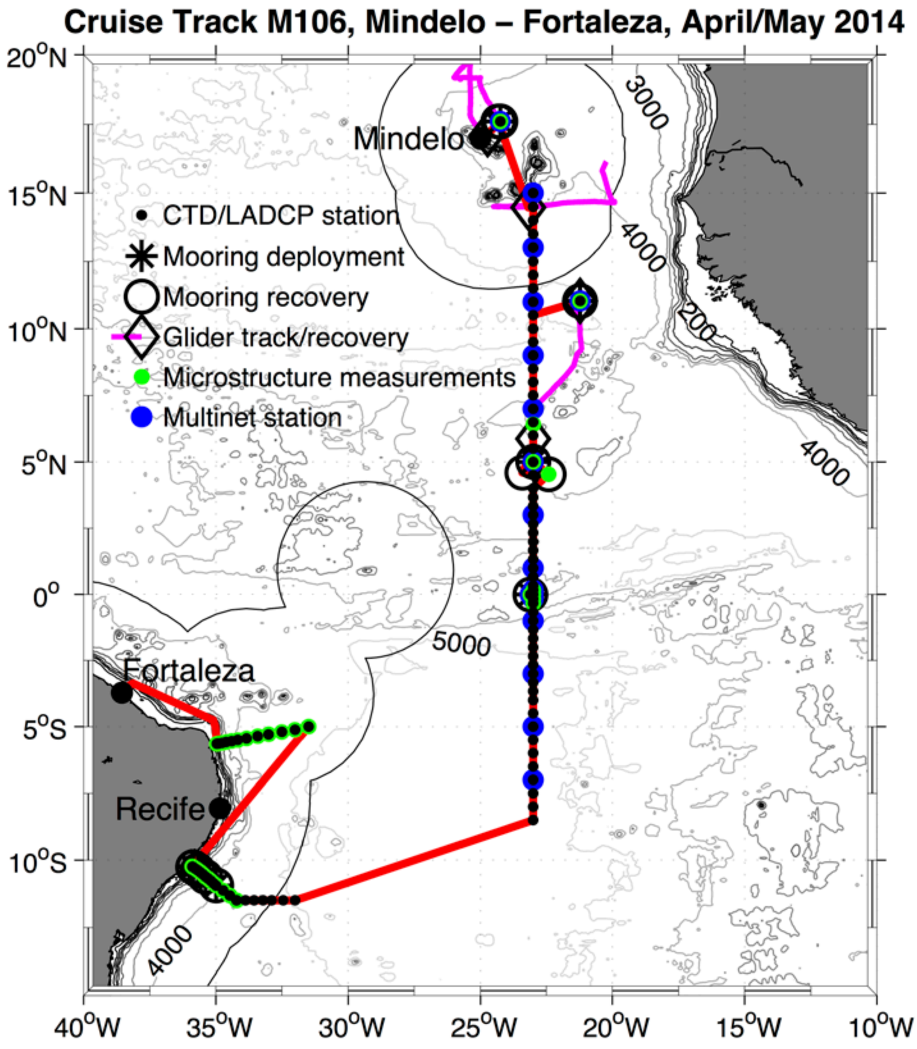

Fig. 4.1. Ship track of R/V METEOR cruise M106 (red line) with locations of CTD/LADCP (black dots) and multinet stations (blue dots), mooring deployments (stars) and recoveries (circles), glider recoveries (diamonds), and microstructure measurements (green dots). Also included are glider tracks (purple lines) and the exclusive economic zones of Cape Verde and Brazil (black lines). Depth contours are drawn at 6000, 5000, 4000, 3000, 2000, 1000, 500, 200, and 50 m.

5 Preliminary Results

In the following a detailed account of the types of observations, the methods and instruments used as well as some of the early results are given.

5.1 CTD system and oxygen measurements and calibration

(Tim Fischer, Wiebke Martens, Bendix Vogel, Philip Tuchen, Ellen Schweizer)

During M106, 118 profiles of pressure (p), temperature (T), conductivity (c) and oxygen (O) were recorded. 83 of these CTD-O_2 profiles ranged to the bottom, the remaining profiles ranged to 1300m or shallower. When additional water samples were needed, a second CTD cast at the same place was taken which usually ranged to 100m. We used a Seabird Electronics (SBE) 9plus system, attached to the water sampler carousel, and the latest Seabird Seasave software. The SBE underwater unit had two sensor sets: p #1162, T1 #5806, c1 #3959, O1 #1812, T2 #5807, c2 #4164, O2 #1818. The two sensor sets worked properly during the entire cruise. The primary sensor set was chosen for recording, it being slightly less noisy. Conductivity was calibrated using a linear relation in p, T and c. This relation was obtained by fitting the according CTD salinity to 360 water samples, which were analyzed using a Guildline Autosal salinometer. The rms salinity misfit was 0.0014 after removal of 33% of bottle values. Oxygen was calibrated using a relation linear in T and O, and quadratic in p. Winkler titration of 450 bottle samples led to a relation with an rms misfit of 0.9 µmol/kg (33% of bottle values removed). Further sensors were attached to the carousel and recorded, but were not calibrated: a fluorescence and turbidity sensor (Wetlabs), and a Photosynthetically Active Radiation (PAR) sensor (Biospherical). The latter could only be used during casts less than 2000m deep. An altimeter, which did not interfere with the LADCP system, detected the CTD's distance to the bottom until profile #93, then failed and could not be repaired.

5.2 Current observations

5.2.1 Vessel mounted ADCP

(Tim Fischer, Robert Kopte)

Current measurements of the upper ocean have been performed continuously throughout the cruise using R/V METEOR's two RDI Ocean Surveyor (OS) instruments (38 kHz and 75 kHz). Both Ocean surveyor instruments worked well throughout the cruise.

The OS75 was configured to sample data in broadband mode for the first half of the cruise until May 12, 2014, 16:04 UTC (number of bins: 100, bin length: 8m, blanking distance: 4m, range: 400-600m). Thereafter, the configuration was changed to narrowband mode in order to increase the range over the Brazilian shelf (number of bins: 100, bin length: 8m, blanking distance: 4m, range: 500-700m) and remained unaltered for the remainder of the cruise.

The OS38 was configured to sample data in broadband mode for the first half of the cruise until May 12, 2014, 16:05 UTC (number of bins: 80, bin length: 16m, blanking distance: 8m, range: 800-1000m), although the sampling configuration was altered to narrowband for the data collected between April 19, 2014, 13:11 UTC and April 20, 2014, 13:08 UTC, owed to rough sea state. In concurrence with the OS75, the 38-kHz instrument was switched to narrowband mode (number of bins: 55, bin length: 32m, blanking distance: 16m, range: 900-1200m) on May 12, 2014, 16:05 UTC and remained unchanged for the remainder of the cruise. Generally, the range of the instruments was found to be dependent on the sea state and the ship's speed. Use of the ship's Doppler log degraded the OS75 data quality almost completely. Thruster usage significantly reduced data quality of the 75kHz instrument, but also of the 38kHz instrument from time to time.

Post-processing of the data was carried out separately for broadband (BB) and narrowband (NB) mode. Accounting for a time shift of the heading and position data recorded by the SeaPath device relative to the raw OS data enabled us to significantly reduce the scatter of the calibration angles and of the amplitude factors. The applied shifts as well as mean misalignment angles and amplitude factors plus associated standard deviations are summarized in Tab. 5.1.

OS	Mode	Heading shift	Position shift	Misalignment angle ± Standard deviation	Amplitude factor ± Standard deviation
75	BB	+8.5 sec.	-0.5 sec.	-1.1019° ± 0.6614°	1.0072 ± 0.0106
75	NB	+8.5 sec.	-0.5 sec.	-1.1791° ± 0.6988°	1.0027 ± 0.0104
38	BB	-3.0 sec.	-0.5 sec.	-0.2226° ± 0.4552°	1.0056 ± 0.0075
38	NB	-3.0 sec.	-0.5 sec.	-0.2862° ± 0.6136°	1.0009 ± 0.0094

Tab. 5.1 Heading and position shift (positive/negative: shift to later/earlier time), mean misalignment angle ± standard deviation, and amplitude factor ± standard deviation after optimizing post-calibration of OS raw data.

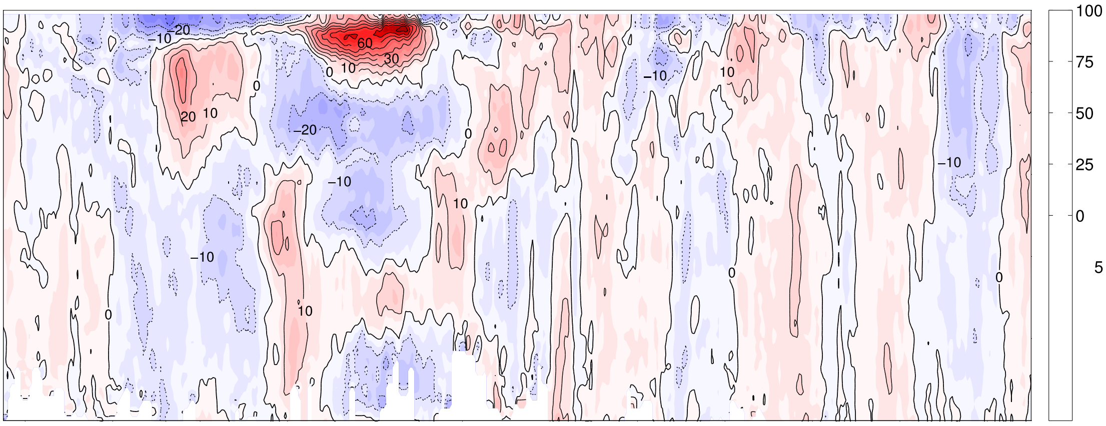

Fig 5.1 Zonal velocity as obtained during M106 along 23°W by OS75 and OS38.

5.2.2 Lowered ADCP

(Rebecca Hummels)

During the entire cruise the CTD system was equipped with a lowered ADCP setup based on two Teledyne RDI ADCPs. The setup consisted of an up-looking and a down-looking 300 kHz instrument. These two instruments were mounted inside the CTD rosette with especially manufactured frames protecting the instruments and allowing zero obstruction of the acoustic beams. A battery pack was mounted below the up-looking slave instrument (initially SN #20507). Both ADCPs were connected to the battery case, which - at least initially – was also the connection point for the data interface cable. In the initial setup, the down-looking master instrument was SN #20508. (Note that LADCP profile numbers were kept the same as CTD cast numbers and profiles do not exist, when the LADCP system did not work).

During the first seven profiles the described setup worked fine. After profile 7, no communication could be established between the computer and the ADCPs over the data interface cable. Another battery case as well as spare deck units and cables were tested without any success in re-establishing a connection. The only way to eventually communicate with the instruments was to connect them directly to the computer using an ADCP cable. Hence, from profile 15 until the end of the cruise, communication with the instruments utilized a direct cable connection and not the battery case. Before acquiring profile 15, the communication with SN #20508 worked fine via the direct cable connection, whereas SN #20507 kept sending cryptic signals. Therefore it was replaced with SN #11436 as up-looking slave. After profile 16, no connection to SN #20508 could be established presumably due to a short circuit in the cable connection. Hence profiles 18-23 are performed with SN #20507 as master. Unfortunately SN #20507 experienced malfunctions over increasing depth intervals and a complete break down during profile 23. The connection between the computer and SN #20507 could not be re-established after profile 23 and therefore SN #20507 was replaced by SN #11461 as down-looking master. With this configuration (SN #11461 as master and SN #11436 as slave) profiles 24-63 could be acquired without any further problems. During profile 64, SN #11461 had malfunctioned over a significant depth interval and was replaced by the ADCP recovered from the CVOO mooring (SN #1972). Unfortunately, this resulted in a defective profile as it turned out that SN #1972 was not properly configured for use as LADCP. However SN #11461 worked again after reinstalling a loose nut and washer which had fallen on the electric board. During profiles 66-83, the system worked without any further malfunctions. However, beam performance and range of the two instruments gradually decreased. After a reset, SN #20507 was re-connected to the computer and was therefore installed as master (profiles 84-91) to improve beam performance and range for the down-looker. Unfortunately, it had another complete break-down below 400m depth during profile 91. For profile 92, the reconfigured CVOO ADCP #1972 was used, but the profile was defective once again. Presumably the ambiguity velocity could not be set to the appropriate value for use as an LADCP. Despite of the decreased beam performance and range, SN #11461 was re-installed as master and the system worked until the end of the cruise (profiles 92-117). Despite all the various instrumental failures, a total of 104 LADCP profiles were acquired.

Data processing took place during the cruise using the GEOMAR LADCP processing software V10.19, which includes both shear and inversion methods to derive an absolute velocity profile. As additional data were necessary for the processing, the corresponding pre-processed CTD files containing pressure, temperature and salinity profiles as well as time and navigation data were used.

Overall, the RDI instruments resulted in good deep ocean velocity profiles when processed in conjunction with the observations of the vessel-mounted ADCP (VMADCP). The use of the 75kHz VMADCP data was preferred. Due to excessive thruster use on some stations in difficult cases of swell and wind direction combinations, the data of the 75kHz VMADCP on station was heavily contaminated. In these cases the LADCP profiles were processed in conjunction with the 38kHz VMADCP. As an example, the alongshore velocity component measured along the 11°S section off Brazil is shown in Fig. 5.2.

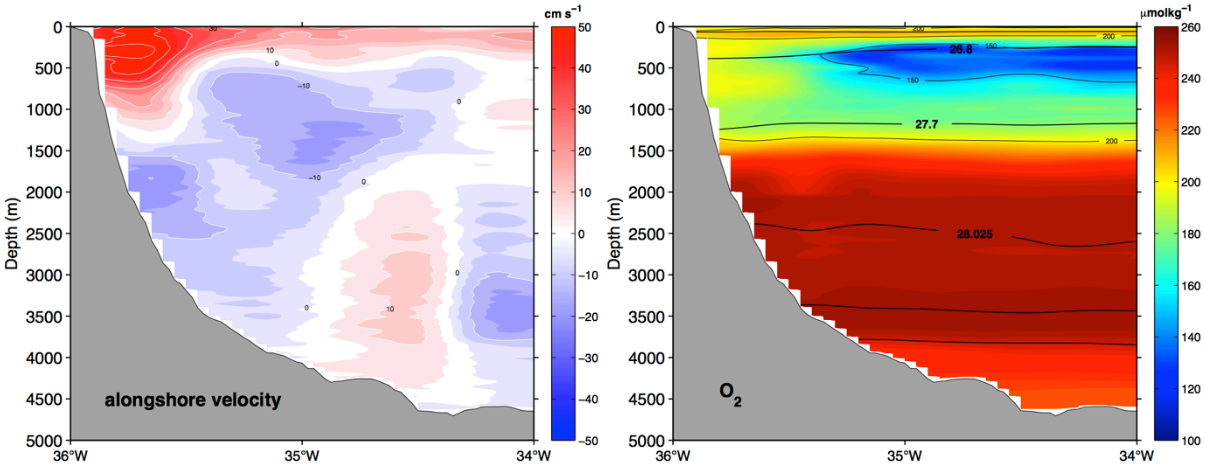

Fig. 5.2 Alongshore velocity (left panel) and oxygen (right panel) along the 11°S section off Brazil.

5.3 Mooring operations

5.3.1 Instrument performance

(Peter Brandt)

Overall the moored instruments recovered during M106 worked very successfully. Tab. 5.2 shows the percentage of obtained data for each mooring and sensor type.

mooring / sensor	T (%)	C (%)	P (%)	U,V (%)	O_2 (%)	other (%)
KPO_1094	94.6	95.3	89.7	75	100	51.3
KPO_1136	-	-	-	-	-	-
KPO_1091	99.9	99.9	100	100	99.8	-
KPO_1093	99.9	97.9	100	100	99.9	-
KPO_1090	94.1	100	100	100	87.5	-
KPO_1092	97.3	100	81.8	100	91.4	-
KPO_1089	95.4	89.3	66.7	91.3	89.3	-
KPO_1095	83.3	100	97.5	97.5	-	-
KPO_1096	87.5	85.7	100	100	-	-
KPO_1097	100	100	100	87.5	-	-
KPO_1098	100	100	100	100	-	-
all moorings	**95.8**	**96.8**	**92.3**	**92.2**	**94.5**	**51.3**

Tab. 5.2 Instrument performance

Only few instruments/sensors failed during the last mooring period. At the CVOO mooring, the sediment traps did not perform very well. One sediment trap did not turn the bottles at all and only three bottles of the other one were filled. O_2 loggers worked again very well. Out of 37 optodes (36 optodes in loggers and one optode attached at the moored profiler), only one failed (KPO 1090, 500m), all others yield almost complete datasets. Particularly the high sampling rate (5 min) of all loggers deployed in the OMZ worked out very well, demonstrating the large impact of the internal wave field on oxygen time series.

Velocity measurements performed also very well. One problem at the near-coastal moorings off Brazil (KPO 1095 and KPO 1096) was the strong inclination of the upward looking LR

ADCPs, which was the combined result of very strong currents and mooring elements (2 MicroCATs) above the LR ADCPs. After we noticed this behavior, we changed the design of these two moorings. For the new deployments, the LR ADCPs were deployed as the top elements, which should strongly reduce inclination angles, but of course does not allow temperature and salinity measurements in the core of the NBUC.

The McLane Moored Profiler deployed at the equator did run the entire mooring period. However the measurement range, targeted to be between 3500 m (lower limit) and 1000 m (upper limit), declined over time and at the end of the mooring period the profile only very occasionally reached the upper limit. The time series of zonal velocity at equator, 23°W covers now more than 10 years or about two and a half equatorial deep jet cycles.

5.3.2 Instrument calibration for Mini-TDs, MicroCATs and optodes

(Johannes Hahn)

CTD-O_2 cast calibrations were performed for all Mini-TDs, MicroCATs and optodes either as pre- or post-deployment calibrations (CTD casts 001, 003, 005, 012, 013, 016, 017, 020, 030, 032, 048, 078, 092 and 112). During each cast, 8 calibration stops were done on average with a duration of at least 4 min (Mini-TDs and MicroCATs) and 2 min (optodes), respectively, in order to ensure equilibrium at each calibration point.

Additionally, onboard lab calibrations were conducted for all optodes in water-filled beakers of 0% and 100% O_2-saturated water at two different temperatures (~9°C and ~22°C) following the Aanderaa optode manual.

Moreover, 2 calibration runs with 7 optodes each were performed in a 60cm x 40cm x 40cm pneumatic trough against 100% O_2-saturated water at ~10°C. An aquarium pump with an air stone at the water surface as well as an additional Seabird pump at the bottom of the pneumatic trough ensured a homogenized water bath. Winkler triplicates were sampled as a reference for each of the 2 calibration runs.

5.3.3 Preliminary results

(Johannes Hahn, Rebecca Hummels, Peter Brandt)

Moored oxygen measurements covering the period from October 2012 to May 2014 were very successful. As an example, oxygen time series from the triangular mooring array at the southern rim of the ETNA OMZ are shown in Fig. 5.3. These moorings are aimed at studying the spatial coherence of oxygen fluctuations which are responsible for the lateral eddy flux of oxygen from the well-ventilated equatorial region toward the OMZ core.

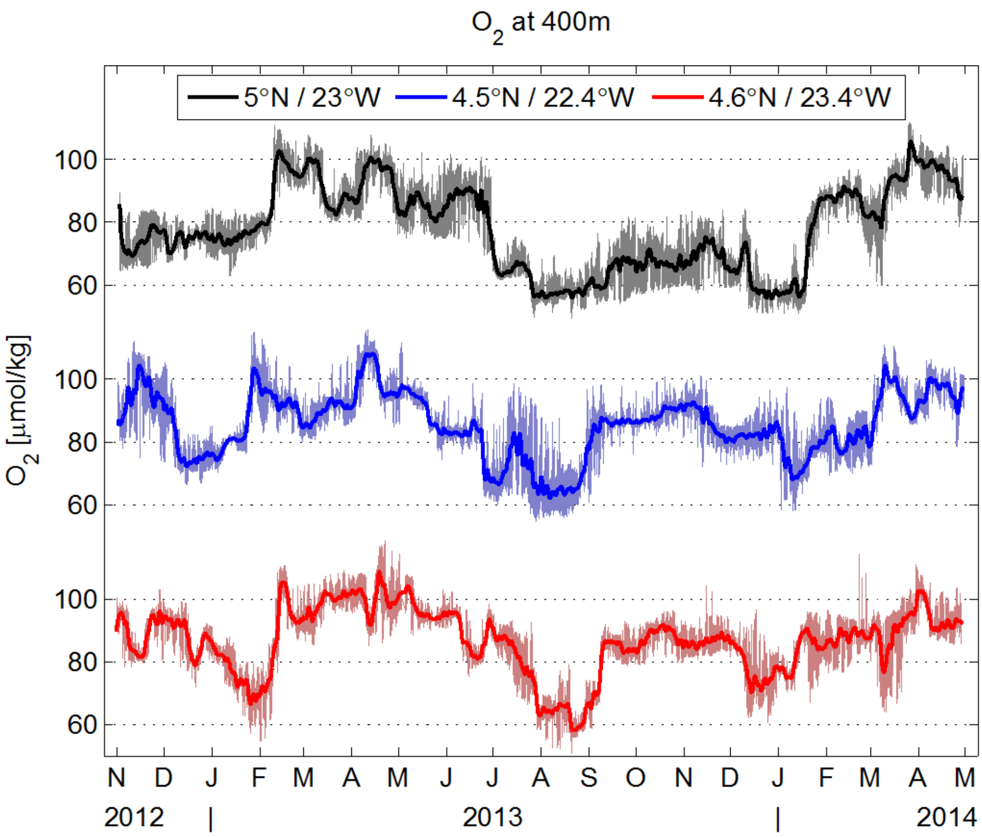

Fig. 5.3 Oxygen time series acquired by three different moorings at the southern rim of the ETNA OMZ at 400m depth showing coherent and non-coherent fluctuations on intraseasonal time scales (thick solid lines). Also visible are short-period fluctuations associated with tidal oscillations (thin solid lines).

As an example for moored current observations, two velocity timeseries of recovered Aanderaa rotor current meters are shown covering the time period from July 2013 to May 2014, both moored at around 1900m depth in moorings K3 and K4, respectively (Fig. 5.4, right panels). These new timeseries can be compared to the timeseries acquired with similar instruments at the same depth levels between 2000 and 2004 (Fig. 5.4, left panels). The former timeseries are dominated by the passage of deep eddies, breaking up the Deep Western Boundary Current (DWBC) and its transport, at around 8°S, as described by Dengler et al. (2004). It was further hypothesized by Dengler et al. (2004) that during weaker periods of the overturning circulation, the break-up of the DWBC into deep eddies might not occur and the transport would instead be accomplished by a laminar flow. However, the new timeseries are also dominated by deep eddies, which at first glance seem to have similar properties to the ones observed between 2000 and 2004.

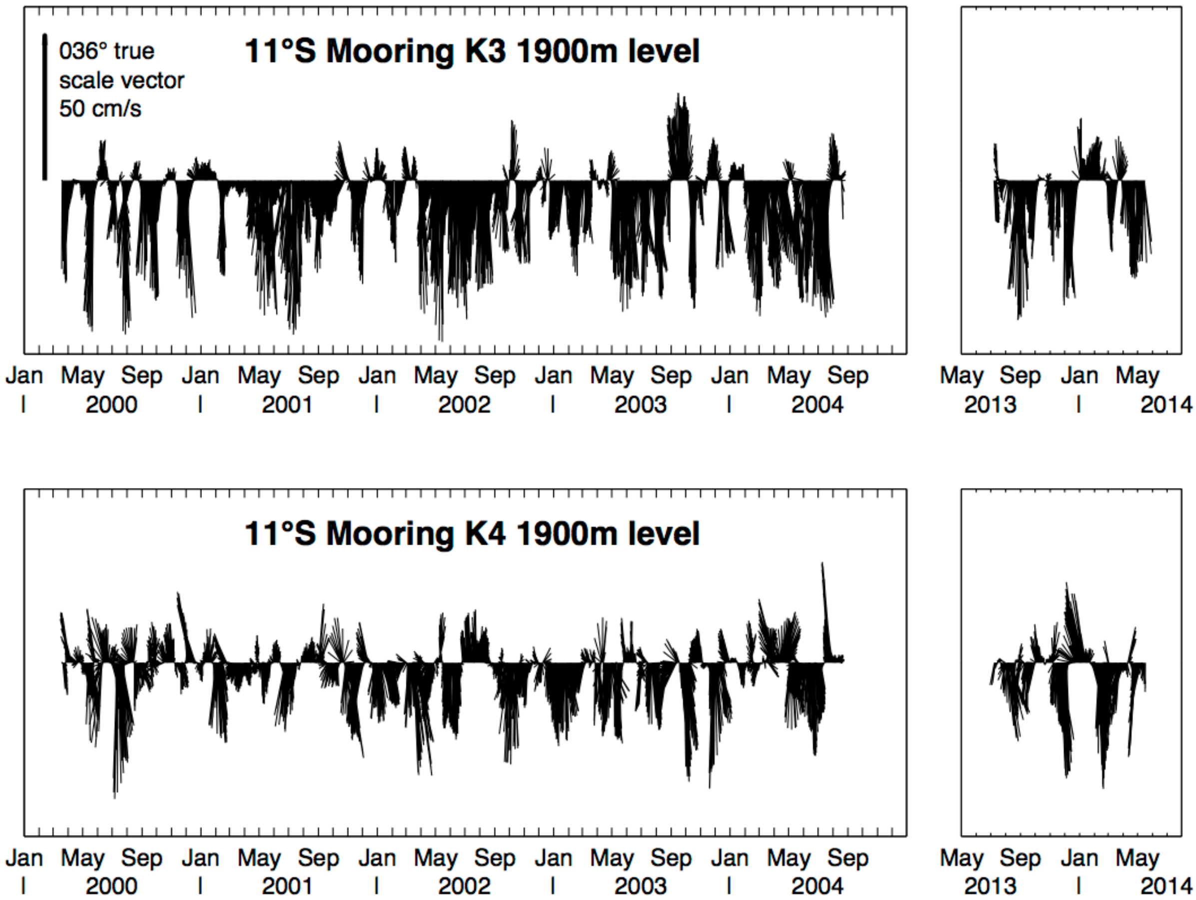

Fig. 5.4 Velocity time series acquired at the continental slope at 11°S off Brazil at 1900m depth. Strong intraseasonal velocity fluctuations are present that are associated with southward propagating DWBC eddies generated at about 8°S.

5.4 Shipboard microstructure measurements

(Tim Fischer)

An MSS90-D microstructure profiler (#032) of Sea and Sun Technology was used to infer turbulent dissipation rate and diapycnal diffusivity, aimed at calculating diapycnal fluxes of oxygen and nitrous oxide (N_2O). The loosely tethered profiler was equipped with 3 airfoil shear sensors and a fast thermistor, as well as a pressure, conductivity, temperature and turbidity sensor each. Profiler sink velocity was adjusted to 0.55 m/s. In total, 120 profiles to maximum 970m depth were recorded at 40 ship stations, generally 3 microstructure profiles following a CTD cast with oxygen and/or N_2O sampling. One third of the profiles was obtained in selected places on or near 23°W, another third covering the 11°S-section off Brazil, the remainder covering the 5°S-section off Brazil. The MSS system worked properly most of the time, apart from occasional communication failures, which could be resolved by routine maintenance procedures.

5.5 Glider operations

(Willi Rath, Peter Brandt)

During M106, four autonomous glider systems manufactured by Teledyne Webb Research were recovered (Tab. 5.3). All four gliders carried a set of standard sensors which included a CTD, an

Aanderaa optode designed to measure dissolved oxygen, and a Wetlabs CHL-a fluorescence and turbidity sensor. In addition to these standard sensors, ifm03 carried an external microstructure sonde manufactured by Rockland Scientific, and ifm13 carried an external Deep Suna nitrate sensor manufactured by Satlantic and a thruster, which helps to overcome currents of up to 2 knots. All four gliders had been deployed on the previous Meteor cruise M105. The first glider, ifm13, was recovered on April 19, 2014 near 17°09'N, 24°43'W. Ifm13 was covering a very low oxygen eddy north of the Cape Verde archipelago that had been tracked for several months. The second glider, ifm02, was recovered on April 21, 2014 near 14°28'N, 23°11'W. The glider participated in a German-French-African upwelling study between Cape Verde and Senegal. The third glider, ifm12, was recovered on April 24, 2014 near the mooring KPO 1091 in the center of the ETNA OMZ at about 11°00'N, 21°00'W. It was programmed to sample spatial and temporal hydrographic variability around the mooring position. The fourth and last glider, ifm03, was recovered on April 28, 2014 near 5°52'N, 23°00'W. It was programmed to perform microstructure measurements along a chain of seamounts between 9°N, 21°W and 6°N, 23°W. All four glider missions were successful and all the measurements were done as planned. All recovery operations were done with the Meteor inflatable boat.

Glider	Date	Time	Latitude	Longitude
Ifm13	April 19	13:25	17°08.81'N	24°43.51'N
Ifm02	April 21	17:20	14°28.33'N	23°10.88'N
Ifm12	April 24	14:35	11°01.81'N	21°13.49'N
Ifm03	April 28	7:35	05°52.10'N	22°59.84'N

Tab. 5.3 Glider recovery operations.

5.6 Biochemical measurements

5.6.1 Zooplankton ecology and particle dynamics

(Rainer Kiko, Pieter Vandromme, Jannik Faustmann, Svenja Kühnle, Ulrike Panknin)

A Hydrobios® Multinet Midi with an aperture of 0.25 m^2 and 5 net bags (mesh size 200 µm) was deployed at 13 daytime and 9 nighttime stations for vertically stratified hauls (sampling depths: 1000-600 m, 600-300 m, 300-200 m, 200-100 m, 100-0 m). Samples were fixed in 4% formaldehyde in seawater solution. They will be scanned and analyzed in the home laboratory using automated imaging software allowing taxonomical classification and biomass estimation.

During 115 CTD casts, an UVP 5 (serial number 10) was operated on the CTD rosette. The instrument consists of one down-facing HD camera in a 6000 dbar pressure-proof case and two red LED lights which illuminate a 0.88 L-water volume. During the downcast, the UVP takes 3-11 pictures of the illuminated field per second. For each picture, the number and size of particles are counted and stored for later data analysis. Furthermore, images of particles with a size > 500 µm are saved as separate "Vignettes" - small cut-outs of the original picture – which allow for later, computer-assisted identification of these particles and their grouping into different particle, phyto- and zooplankton classes. Since the UVP was integrated in the CTD rosette and interfaced with the CTD sensors, fine-scale vertical distribution of particles and major planktonic groups can be related to environmental data.

Standard depths for POC/PON/POP sampling were 10 m above bottom, 3500, 1500, 800, 450, 250, 150, 100, 75, 50, 25 and 10 m (plus additional depths at CVOO) and 345 samples were taken at 26 stations. PO_4, NO_3, NO_2, SiO_4 and NH_4 samples were taken at the same depths and additionally at depths where N_2O measurements (section 5.6.3) were conducted (495 samples at 34 stations). Chl-a samples were taken at 150, 100, 75, 50, 25 and 10 m depth at 31 stations (202 samples). Furthermore, 39 samples for the measurement of rare earth elements and Neodymium isotope composition were taken on 12 stations. 71 samples for the determination of the abundance of hydrogenase genes were taken on 8 stations. PO_4, NO_3, NO_2, SiO_4, POC/PON/POP, rare earth element and DNA samples will be analyzed in the home laboratory, whereas NH_4 and Chl-a were measured fluorometrically directly on board. In order to assess microbial planktonic respiration, in vivo electron transport system activity was assessed with an INT reduction assay according to Martinez-Garcia et al (2009). 20 assays were conducted on 20 stations.

5.6.2 Incubation experiments for estimating N_2 fixation and primary productivity

(Arvind Singh, *PI: Ulf Riebesell*)

The equatorial part of the Atlantic Ocean has been overlooked by biogeochemists because it receives ample amount of nutrients through upwelling. Therefore, chances of N_2 fixation, as per old paradigm, are less. However, excess PO_4^{3-} through upwelling in this region might play a role in enhancing N_2 fixation.

Incubation experiments were conducted to meet the following objectives:

- Estimate N_2 fixation and primary production during spring in the tropical and equatorial part of the Atlantic Ocean. Experiments were performed using a newly developed method.
- Simulate upwelling to understand its impact on N_2 fixation. This was done by adding water from OMZs to the euphotic zone waters.

Stable isotopes of nitrogen (^{15}N) and carbon (^{13}C) were used in incubation experiments to study the above objectives. A total of 25 N_2 fixation and carbon uptake incubation experiments have been performed along the 23°W transact and off-Brazil in the Atlantic Ocean (Tab. 5.4). In addition, three stations were sampled for high-resolution natural isotopic composition of particulate organic matter. Water samples were collected from 4 different depths, mainly corresponding to 100, 50, 25, 13% light levels, to cover the entire euphotic zone. Samples were collected using Niskin bottles attached to the CTD rosette sampler. Sample water was filled, in triplicates, into 2.8 L polycarbonate Nalgene bottles. This was followed by addition of 50 mL $^{15}N_2$ enriched water and 1 mL $NaH^{13}CO_3$ (0.2 mmol/mL, 99 atom %) tracer to individual samples. Samples were then incubated on deck after putting on light filters to simulate the light levels for the corresponding depths. Seawater was continuously circulated during the incubation to maintain the temperature. Samples were incubated for 24 hrs. All samples were filtered subsequently through pre-combusted (4 hrs at 400°C) 25 mm diameter and 0.7 µm pore size Whatman GF/F filter, dried in an oven at 50°C overnight and preserved for mass-spectrometric analysis at the on shore laboratory.

Upwelling events were simulated at two sampling locations along with above mentioned regular (natural) experiments. 500 ml water from the OMZs was added to 2.8 L polycarbonate Nalgene bottles, subsequently bottles were filled with the corresponding depth waters.

The following samples were collected at the beginning of each incubation: Samples for nutrient (NO_3^-, NH_4^+, PO_4^{3-}, SiO_4) measurements were collected in 15 ml tubes from each depth and preserved at -20 °C. Samples for high-performance liquid chromatography (HPLC) were filtered through 0.7 µm pore size Whatman GF/F filters and were preserved at -80 °C for further analysis. Flow cytometry samples were collected in 5 ml Nalgene tubes to estimate cell abundance. These flow cytometry samples were poisoned with 200 µl 5% Glutardialdehyde (GDA) in 4.5 ml water samples for bacteria and 100 µl formalin/hexamine mixture (18% v/v formalin, 10% w/v hexamine) in 3.5 ml water sample for nanoplankton.

All the above mentioned samples (frozen and dried both) will be brought to GEOMAR, Kiel for analysis.

CTD NO	Station No.	Lat (°N)	Long (°W)	Date	remarks
3	322	17.60	-24.25	20-04-2014	
4	326	15.00	-23.00	21-04-2014	
9	330	13.00	-23.00	22-04-2014	
24	344	6.97	-22.98	27-04-2014	
26	347	6.00	-23.00	28-04-2014	
33	352	5.03	-22.98	30-04-2014	time_series_station
34	354	4.00	-23.00	30-04-2014	
38	357	3.00	-23.00	01-05-2014	time_series_station
41	360	2.00	-23.00	02-05-2014	
45	363	1.00	-23.00	02-05-2014	upwelling_simulation
49	367	0.17	-23.00	03-05-2014	
50	368	-0.17	-23.00	03-05-2014	
52	371	0.00	-23.02	04-05-2014	upwelling_simulation
58	374	-1.00	-23.00	05-05-2014	
61	377	-2.00	-23.00	06-05-2014	
64	380	-3.00	-23.00	07-05-2014	
70	385	-5.00	-23.00	08-05-2014	
74	389	-7.00	-23.00	09-05-2014	
80	394	-11.50	-32.45	13-05-2014	
87	405	-10.27	-35.86	14-05-2014	
101	420	-10.62	-35.38	19-05-2014	
103	422	-5.00	-31.50	21-05-2014	
105	424	-5.21	-32.50	21-05-2014	natural ^{15}N
108	426	-5.36	-33.42	22-05-2014	
110	428	-5.50	-34.17	22-05-2014	natural ^{15}N
114	431	-5.61	-34.77	23-05-2014	Only natural ^{15}N
117	433	-5.64	-34.93	23-05-2014	Only natural ^{15}N
118	434	-5.65	-34.96	23-05-2014	Only natural ^{15}N

Tab. 5.4 Details of N_2 fixation and carbon uptake sampling

5.6.3 Nitrous oxide distributions and production pathways

(Damian Grundle)

Nitrous oxide is an important greenhouse gas which has a per mol global warming potential ~300 times that of CO_2. In the ocean, N_2O is produced either by nitrifying bacteria and archaea (via the NH_4^+ oxidation or nitrifier-denitrification pathways) or by denitrifying bacteria. Dissolved oxygen (DO) concentrations play a key role in determining which of these microbial groups and production pathways will predominate. Perhaps more importantly, however, is that

DO concentrations can regulate the overall amount of N_2O which is produced – at very low DO concentrations N_2O production can increase exponentially. In relation to other Atlantic Ocean regions, the tropical Atlantic appears to be somewhat of an N_2O hotspot as concentrations in the tropical regions of the Atlantic are much higher than those at higher latitudes, and this is despite the fact that DO concentrations are, at present, not low enough to cause substantial increases in N_2O production. Given that DO concentrations in the tropical Atlantic are predicted to continue decreasing through this century, it is possible that N_2O production, bulk N_2O pools and emissions to the atmosphere will increase further. If we are to fully understand the magnitude of these potential increases, it is important that we understand the present N_2O conditions (i.e. N_2O concentrations and distributions, and pathways and rates of N_2O production) in the tropical Atlantic. To this end, I collected samples during the M106 cruise which will be used to investigate spatial variations of N_2O concentrations (Tab. 5.5). These samples were collected at ~10 depths spanning the oxygenated surface waters to the core of the OMZ and along a N-S and E-W transects. At select stations high resolution sampling (in terms of number of depths sampled) for N_2O concentration measurements were also conducted in order to enable better estimates of N_2O diffusion into the mixed layer to be made. Samples for the measurement of N_2O concentrations were collected with a rosette configuration of Niskin bottles and following standard dissolved gas sampling techniques. Firstly, water was transferred from the Niskin bottle to 20 ml serum bottles using a Tygon tube. The Tygon tube was placed at the bottom of the serum bottle and seawater was transferred using the overflow technique until the sample water had been replaced approximately three times. Following collection, the samples were capped with butyl-septa stoppers and aluminum O-rings, and then the samples were poisoned with saturated mercuric chloride.

Station	Lat/Long	Depth Range (m)	Total # of Depths	Parameters Measured			
				N_2O Conc.	N_2O Isotopes	N_2O Production	NO_3^- Isotopes
326	15°N, 23°W	5-1000	10	x	x	x	x
332	12°N, 23°W	5-1000	10	x	x		x
340	9°N, 23°W	5-1000	10	x	x		x
347	6°N, 23°W	5-1000	10	x	x		x
357	3°N, 23°W	5-1000	10	x	x	x	x
366	0°N, 23°W	5-1000	29	x	x	x	x
380	3°S, 23°W	5-1000	10	x	x		x
389	7°S, 23°W	5-1000	10	x	x	x	x
424	5° 12.3 S, 32° 30.0 W	5-1400	21	x	x		x
426	5° 21.75 S, 33° 25.0 W	5-1200	10	x	x		x
428	5° 30.2 S, 34° 10.0 W	5-1200	10	x	x		x
431	5° 36.65 S, 34° 46.0 W	5-1400	21	x	x		x
433	5° 38.35 S, 34° 56.0 W	5-bottom (~715)	9	x	x		x
434	5° 39.0 S, 34° 57.6 W	5-bottom (~345)	12	x	x		x

Tab. 5.5 Outlines the stations which were sampled for N_2O related work during M106 along with a summary of the depth range, number of depths and the parameters which were sampled.

In addition to collecting samples for measuring N_2O concentrations, I also collected samples for measuring N_2O and NO_3^- isotope signatures at the same stations and depths as N_2O concentration samples. The N_2O isotope samples were collected following the same protocols for N_2O concentration sample collection, while the NO_3^- isotope samples were collected from the Niskin bottles, filtered through a 0.2 µm filter and then frozen. Results from these measurements will allow us to determine the relative importance of the different N_2O production pathways to bulk N_2O pools in the tropical Atlantic and will provide insight into how different environmental gradients (e.g. DO, nutrients, salinity) impact the relative importance of these production pathways. Furthermore, at select stations and depths (typically three depths through the oxycline) ^{15}N tracer incubation experiments were also conducted in order to measure the rates of N_2O production via each of the different production pathways (i.e. NH_4^+ oxidation, nitrifier-denitrification, and denitrification). For each sampling event in which rates of N_2O production were measured, 8 x 160 ml water samples were collected following the same protocols outlined for N_2O concentration sample collection. Following collection, duplicate samples were amended with ^{15}N-labelled NH_4^+ (for measuring N_2O production via NH_4^+ oxidation), ^{15}N-labelled NO_2^- (for measuring N_2O production via nitrifier-denitrification) and ^{15}N-labelled NO_3^- (for measuring N_2O production via denitrification). The remaining two samples were left un-amended and served as controls. Samples were then incubated under in situ temperatures for approximately 24 hours, after which they were poisoned with saturated mercuric chloride.

5.6.4 Underway *p*CO_2, O_2 and GTD measurements

(Tobias Steinhoff, Björn Fiedler, *PI: A. Körtzinger*)

Underway measurements of surface water *p*CO_2 were performed using a commercially available GO-*p*CO_2 measuring system (General Oceanics, Miami, FL). The instrument is described in detail in Pierrot et al. (2009).

A submersible pump and a temperature sensor (SBE38, SN# 3847374-0366, Sea-Bird Electronics Inc, Bellevue, USA) were installed in the ship's moon pool at approximately 5 m depth. The pump supplied a continuous flow of surface water to the underway instruments (GO-System, through-flow box and bypass). A calibration of the IR-sensor was performed approximately every three hours by using three different standard gases containing ambient air with different partial pressures of CO_2 (347.3, 450.2 and 670.8 ppm). The standard gases were calibrated against NOAA primary standards. After every control measurement, atmospheric *p*CO_2 was measured for several minutes. Therefore air was pumped through a piping from the top of the ship. All temperature sensors were calibrated against international standards.

Underway measurements of surface water oxygen (O_2) and salinity were carried out in a flow-through box. The following sensors were implemented: Oxygen optodes (model 4330, SN# 1082, Aanderaa Data Instruments AS, Bergen, Norway) and conductivity sensor (SN# 772, Aanderaa Data Instruments AS, Bergen, Norway).

5.7 Atmospheric measurements

(Cedrick Ansorge)

During the cruise M106, R/V METEOR's ship meteorological observations were extended by in-situ high-resolution part-sky infrared imaging and direct measurements of incident sun radiation at five wavelengths (MICROTOPS) in different absorption bands.

The analysis of part-sky infrared images taken every 10 seconds allows a highly resolved description of cloudiness along the cruise-track of M106. Fig. 5.5 shows the average daily evolution of cloud cover unveiling interesting dynamics in tropical cloudiness over the Atlantic:

1. The low-cloud cover (thick red line in Fig. 5.5) reaches an absolute minimum right before sunset, illustrating a collapse of active convection towards the end of the day.
2. Typical of marine conditions, a secondary maximum in low-cloud cover is observed a few hours after sunset. The increase of low-cloud cover preceding this maximum coincides with the minimum of the 4 hPa strong semi-diurnal pressure wave around 1800 UTC-1 providing a large-scale forcing for active convection through weaker subsidence.
3. The early-night maximum in low-cloud cover (T_{rad}>15˚C) precedes an increase of high-cloud cover (-2˚C<T_{rad}<10˚C) over the course of the night, which in turn is followed by a substantial decrease in the hours around sunrise where lower clouds take over. Given the dynamics of stratocumulus formation at the cloud top, this is consistent with the decrease of turbulent fluxes of latent heat (manifest in less low clouds) favoring the formation of stratiform clouds. This rather weak forcing in favor of stratiform clouds is more effective during night-time were the radiative heat loss at the cloud top has stronger influence on the local heat budget. In the hours after sunrise, vice versa, low clouds form whereas the stratiform clouds dissipate. Closer inspection shows, the increase in low-cloud cover precedes the decrease of high-cloud cover by approximately one hour, and it illustrates that a re-coupling of the residual layer, which contains the stratiform clouds, on top of the PBL is necessary to dissipate stratiform clouds.

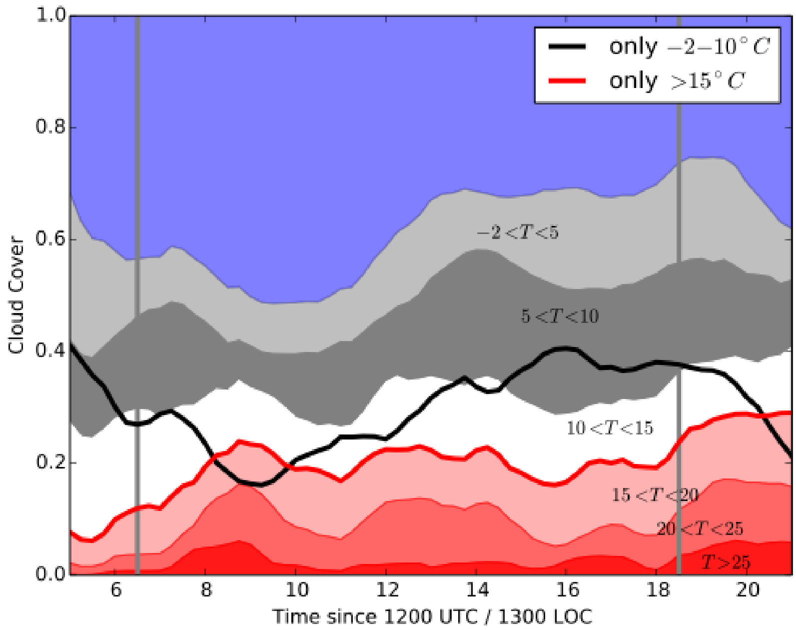

Fig. 5.5 Daily cycle of cloud cover with various radiation temperatures averaged over the period 17 Apr—09 May 2014, where RV METEOR was going southward at 23˚W. The black line shows the average fraction with radiation temperatures between -2˚C and 10˚C (grey shading), a proxy for high clouds. The thick red line shows the average fraction with radiation temperatures above 15˚C (red shading), a proxy for low clouds. The grey vertical lines illustrate the approximate timing (±20 minutes) of sunset and sunrise.

5.8 Multibeam echosounder

(Tim Fischer)

During the first part of the cruise outside Brazilian waters, the 12-kHz multibeam echosounder EM122 continuously recorded bathymetry and water column backscatter. The system pinged at 10-second-intervals with a bin size of 8m. There were no interferences to the 38kHz and 75kHz ADCP systems. The data were taken to infer the possibility of studying characteristics of zooplankton abundance and migration.

6 Ship`s meteorological station

(M. Stelzner)

R/V METEOR left the port of Mindelo on April 19 at 9:00. First station was northeast of Sao Vincente. At this time, a high was located west of the Azores that moved slowly southeast over the next days. From this, a ridge extended towards the research area of R/V METEOR and dominated the weather. When leaving the port of Mindelo, the north-northeasterly wind reached 7 Bft due to local effects. After leaving the area influenced by Cape Verde, the wind decreased soon to 5 Bft. Significant wave height was about 2 to 2.5 m with a swell from NNE. Visibility was moderate to good, the 22.5 °C of the water temperature exceeded air temperature (22 °C) only a little. This situation remained almost constant during the next two days.

On the afternoon of April 21, the transit started to position 15°N 23°W from where the section along the 23°W meridian should begin. When passing the area west of the island of Sao Nicolau and between the islands of Sao Tiago and Maio, local jets enhanced the north-northeasterly wind to 6 to 7 Bft again. The wave height remained at 2 to 2.5 m with a swell from NNE. At the afternoon of April 22, R/V METEOR reached the target position and station work started. Extending from the high which was located southwest of the Azores now, the ridge was still dominating the weather in the area of R/V METEOR. With the mean wind speed decreasing to 3 to 4 Bft, the significant wave height decreased and remained at about 1 to 1.5 m until April 27, with a swell from north.

On April 28, R/V METEOR reached latitude 5°N. Due to a second significant swell from the south, cross swells occurred repeatedly, with the dominating part changing from north to south and vice versa for some time. On the track to the south, water temperature increased slowly from April 22 and reached a maximum value of 30.4 °C on April 30. Air temperature increased as well to 28 °C, and visibility was always good to excellent.

Beginning on April 28, R/V METEOR approached the northern Part of ITCZ, the intertropical convergence zone, that become dominant for the weather. High cumulus clouds and intense rain showers became a daily occurence.

On May 1, the wind turned southeast and remained constant at 4 Bft until the evening of May 2. During the following night, the wind increased to 6 Bft inside an intense rain shower for some time, with gusts reaching 8 Bft. Later this night, the wind was weak and variable, increasing to 4 Bft from the south the next morning. Until noon of May 4, the wind veered west-southwest, backing southeast in the morning hours of May 5 and increased to 5 Bft. On May 7, it backed further to east and remained stationary until May 11.

During those days, swell was very variable as well. On May 1, it came from the southwest at first, later from different directions. In the evening, a cross swell from northwest and south occurred. The significant wave height was about 1 m for the whole day. Beginning on May 2, the southerly swell became dominant, increasing to 1.5 m. This situation remained until May 6. On May 7, the swell increased to 2 to 2.5 m and turned to a southeasterly direction, remaining until the May 10.

The section along longitude 23°W was completed on May 10 and transit to the next working area near the Brazilian coast started. In the meantime, R/V METEOR has left the ITCZ, now cruising in a southern area of minor pressure gradients. Influenced by a high-pressure system near 36°S, 45°W, the southeasterly wind blew steady at 4 to 5 Bft. Significant wave height was about 1.5 m with a swell from the southeast. Water temperature still was about 28 °C, air temperature remained at 26 to 27 °C, and visibility was good to excellent except for the rain showers that became more frequent near the Brazilian coast. This weather situation remained almost steady until May 18.

The transit towards north to position 5°S, 31.5°W started during the night to May 19. From that position the last section towards the Brazilian coast was made. During the transit, a small low was located northeast of the working area, near 4°S, 31°W. Withdrawing to the west, it dominated the weather for some time. The southerly wind backed northeast, weakening to 2 to 3 Bft for some time but increasing to 4 Bft again soon. Significant wave height of 1.5 m, with the swell from the southeast, didn't change. The chance of showers increased, but water and air temperature remained unchanged as well as visibility.

The last section ended on May 24, and R/V METEOR started the transit towards Fortaleza. The wind came from east to southeast at 4 to 5 Bft. Significant wave height was about 1.5 to 2 m with the swell coming from east. In the morning hours of May 26, R/V METEOR reached roadstead off Fortaleza, entering the port in the afternoon.

7 Lists M106

7.1 Station list

Station No. M106 Ship/Science		Latitude	Longitude	Time	Work
M106_ 321-1	Ifm13	17°08.8'N	24°43.5'W	19.04. 12:20-12:40	**Glider recovery**
M106_ 322-1	KPO_1094	17°36.40'N	24°14.98' W	19.04. 17:00-20:40	**Mooring** recovery
M106_ 322-2	CTD_1	17°36'N	24°15'W	19.04. 21:40-0:40	**CTD/LADCP** station (3598m/bottom),
M106_ 322-3	CTD_2	17°36'N	24°15'W	20.04. 1:50-3:00	**CTD/LADCP** station (1000m)
M106_ 322-4	MN_1	17°36'N	24°15'W	20.04. 3:20-4:10	**Multinet**
M106_ 322-5	CTD_3	17°36'N	24°15'W	20.04. 4:40-7:30	**CTD/LADCP** station (3597m/bottom)
M106_ 323-1	KPO_1136	17°36.27'N	24°18.82'W	20.04. 8:10-10:50	**Mooring** recovery
M106_ 324-1	MN_2	17°36'N	24°15'W	20.04. 11:50-12:40	**Multinet**
M106_ 324-2	KPO_1128	17°36.354'N	24°14.976'W	20.04. 15:10-19:40	**Mooring** deployment
M106_ 324-3	MSS_1	17°36'N	24°15'W	20.04. 20:10-21:40	**Microstructure**
M106_ 325-1	Ifm02	14°30'N	23°10'W	21.04. 15:50-16:30	**Glider recovery**
M106_ 326-1	CTD_4	15°00'N	23°00'W	21.04. 20:30-20:50	**CTD/LADCP** station (120m)
M106_ 326-2	MN_3	15°00'N	23°00'W	21.04. 21:00-22:00	**Multinet**
M106_ 326-3	CTD_5	15°00'N	23°00'W	21.04. 22:20-0:40	**CTD/LADCP** station (2737m/bottom)
M106_ 327-1	CTD_6	14°30'N	23°00'W	22.04. 3:50-4:40	**CTD/LADCP** station (1300m)
M106_ 328-1	CTD_7	14°00'N	23°00'W	22.04. 7:40-10:10	**CTD/LADCP** station (4317m/bottom)
M106_ 329-1	CTD_8	13°30'N	23°00'W	22.04. 14:00-16:00	**CTD/LADCP** station (1300m)
M106_ 330-1	CTD_9	13°00'N	23°00'W	22.04. 18:00-20:50	**CTD/LADCP** station (4731m/bottom)
M106_ 328-1	CTD_7	14°00'N	23°00'W	22.04. 7:40-10:10	**CTD/LADCP** station (4312m/bottom)
M106_ 329-1	CTD_8	13°30'N	23°00'W	22.04. 14:00-16:00	**CTD** station (1300m)
M106_ 330-1	CTD_9	13°00'N	23°00'W	22.04. 18:00-20:50	**CTD** station (4731m/bottom)
M106_ 330-2	MN_4	13°00'N	23°00'W	22.04. 21:10-22:00	**Multinet**
M106_ 331-1	CTD_10	12°30'N	23°00'W	23.04. 1:00-1:50	**CTD** station (1300m)
M106_ 332-1	CTD_11	12°00'N	23°00'W	23.04. 4:50-7:40	**CTD** station (5037m/bottom)

Station No. M106 Ship/Science		**Latitude**	**Longitude**	**Time**	**Work**
M106_ 333-1	CTD_12	11°30'N	23°00'W	23.04. 10:30-12:00	**CTD** station (1300m)
M106_ 334-1	MN_5	11°00'N	23°00'W	23.04. 16:10-17:10	**Multinet**
M106_ 334-2	CTD_13	11°00'N	23°00'W	23.04. 17:30-21:10	**CTD** station (5144m/bottom)
M106_ 334-3	MN_6	11°00'N	23°00'W	23.04. 21:10-22:20	**Multinet**
M106_ 335-1	CTD_14	10°30'N	23°00'W	24.04. 1:20-2:10	**CTD** station (1300m)
M106_ 336-1	Ifm12	11°01.8'N	21°13.5'W	24.04. 13:30-13:40	**Glider** recovery
M106_ 337-1	KPO_1091	11°02.216'N	21°13.290'W	24.04. 13:50-17:40	**Mooring** recovery
M106_ 337-2	CTD_15	11°00'N	21°13'W	24.04. 18:20-21:30	**CTD/LADCP** station (5068m/bottom)
M106_ 337-3	MN_7	11°00'N	21°13'W	24.04. 21:40-22:40	**Multinet**
M106_ 337-4	CTD_16	11°00'N	21°13'W	24.04. 23:00-0:20	**CTD/LADCP** station (1300m)
M106_ 337-5/6	MSS_2	11°00'N	21°13'W	25.04. 0:30-6:30	**Microstructure**
M106_ 337-7	KPO_1127	11°02.216'N	21°13.290'W	25.04. 8:50-13:10	**Mooring** deployment
M106_ 337-8/9	CTD_17	11°00'N	21°13'W	25.04. 14:20-15:40	**CTD** station (1300m)
M106_ 337-10	MN_9	11°00'N	21°13'W	25.04. 15:00-16:50	**Multinet**
		10°30'N	23°00'W	26.04. 02:30	
M106_ 338-1	CTD_18	10°00'N	23°00'W	26.04. 5:30-8:20	**CTD/LADCP** station (5029m/bottom)
M106_ 339-1	CTD_19	9°30'N	23°00'W	26.04. 11:20-12:10	**CTD/LADCP** station (1300m)
M106_ 340-1	MN_10	9°00'N	23°00'W	26.04. 15:00-15:50	**Multinet**
M106_ 340-2	CTD_20	9°00'N	23°00'W	26.04. 16:00-19:20	**CTD/LADCP** station (4890m/bottom)
M106-341-1	CTD_21	8°30'N	23°00'W	26.04. 22:20-23:20	**CTD/LADCP** station (1300m)
M106-342-1	CTD_22	8°00'N	23°00'W	27.04. 2:20-5:00	**CTD/LADCP** station (4408m/bottom)
M106-343-1	CTD_23	7°30'N	23°00'W	27.04. 8:00-9:00	**CTD/LADCP/PAR** station (1300m)
M106-344-1	CTD_24	6°58'N	22°58.7'W	27.04. 12:10-13:10	**CTD/LADCP/PAR** station (1312m/bottom)
M106_ 344-2	MN_11	6°58'N	22°58.7'W	27.04. 13:20-14:10	**Multinet**
M106_ 345-1	CTD_25	6°34'N	22°55.5'W	27.04. 16:30-18:40	**CTD/LADCP** station (3351m/bottom)
M106_ 346-1	MSS_3	6°25'N	22°54.5'W	27.04. 20:10-23:30	**Microstructure** (over sea mount)
M106_ 347-1	CTD_26	6°00'N	23°00'W	28.04. 1:50-2:10	**CTD/LADCP** station (100m)

Station No. M106 Ship/Science		**Latitude**	**Longitude**	**Time**	**Work**
M106_ 347-2	CTD_27	6°00’N	23°00’W	28.04. 2:30-5:00	**CTD/LADCP** station (4089m/bottom)
M106_ 348-1	Ifm03	5°52’N	23°00’W	28.04. 6:30-6:40	**Glider** recovery
M106_ 349-1	CTD_28	5°30’N	23°00’W	28.04. 8:50-9:50	**CTD/LADCP/PAR** station (1300m)
M106_ 350-1	KPO_1093	4°36.0’N	23°25.0’W	28.04. 15:30-17:50	**Mooring** recovery
M106_ 351-1	CTD_29	4°30’N	23°00’W	29.04. 20:30-23:20	**CTD/LADCP** station (4118m/bottom)
M106_ 352-1	MSS_4	4°59’N	22°59’W	29.04. 2:30-5:30	**Microstructure**
M106_ 352-2	CTD_30	4°59’N	23°00’W	29.04. 6:00-7:30	**CTD/LADCP** station (1300m)
M106_ 352-3	KPO_1090	5°01.0’N	23°00.0’W	29.04. 7:50-11:20	**Mooring** recovery
M106_ 352-4	CTD_31	5°01’N	23°00’W	29.04. 11:50-12:40	**CTD/LADCP/PAR** station (1300m)
M106_ 352-5	MN_12	5°01’N	23°00’W	29.04. 12:50-13:40	**Multinet**
M106_ 352-6	KPO_1126	5°01.0’N	23°00.0’W	29.04. 15:10-19:10	**Mooring** deployment
M106_ 352-7	CTD_32	5°02’N	22°59’W	29.04. 19:30-21:00	**CTD/LADCP** station (1300m)
M106_ 352-8	CTD_33	4°59’N	23°00’W	29.04. 22:00-0:50	**CTD/LADCP** station (4199m/bottom)
M106_ 352-9	MN_13	4°59’N	23°00’W	30.04. 1:00-1:40	**Multinet**
M106_ 353-1	MSS_5	4°30.0’N	22°25.0’W	30.04. 6:10-7:40	**Microstructure**
M106_ 353-2	KPO_1092	4°32.0’N	22°25.0’W	30.04. 7:50-9:50	**Mooring recovery**
M106_ 354-1	CTD_34	4°00’N	23°00’W	30.04. 15:20-18:00	**CTD/LADCP** station (4212m/bottom)
M106_ 355-1	CTD_35	3°40’N	23°00’W	30.04. 21:10-23:40	**CTD/LADCP** station (4436m/bottom)
M106_ 356-1	CTD_36	3°20’N	23°00’W	01.05. 1:40-4:20	**CTD/LADCP** station (4153m/bottom)
M106_ 357-1	CTD_37	3°00’N	23°00’W	01.05. 6:40-10:00	**CTD/LADCP** station (4641m/bottom)
M106_ 357-2	MN_14	3°00’N	23°00’W	01.05. 10:10-11:00	**Multinet**
M106_ 357-3	CTD_38	3°00’N	23°00’W	01.05. 11:30-11:50	**CTD/PAR** station (200m)
M106_ 358-1	CTD_39	2°40’N	23°00’W	01.05. 14:10-16:50	**CTD/LADCP** station (4699m/bottom)
M106_ 359-1	CTD_40	2°20’N	23°00’W	01.05. 19:10-21:40	**CTD/LADCP** station (4277m/bottom)
M106_ 360-1	CTD_41	2°00’N	23°00’W	01.05. 23:50-0:10	**CTD/LADCP** station (200m)
M106_ 360-2	CTD_42	2°00’N	23°00’W	02.05. 0:40-3:20	**CTD/LADCP** station (4328m/bottom)

Station No. M106 Ship/Science		**Latitude**	**Longitude**	**Time**	**Work**
M106_ 361-1	CTD_43	1°40'N	23°00'W	02.05. 5:40-8:00	**CTD/LADCP** station (4119m/bottom)
M106_ 362-1	CTD_44	1°20'N	23°00'W	02.05. 10:30-13:20	**CTD/LADCP** station (4717m/bottom)
M106_ 363-1	MN_15	1°00'N	23°00'W	02.05. 15:50-17:00	**Multinet**
M106_ 363-2	CTD_45	1°00'N	23°00'W	02.05. 17:10-19:10	**CTD/LADCP** station (3220m/bottom)
M106_ 364-1	CTD_46	0°40'N	23°00'W	02.05. 21:30-23:50	**CTD/LADCP** station (3898m/bottom)
M106_ 365-1	CTD_47	0°20'N	23°00'W	03.05. 2:10-4:30	**CTD/LADCP** station (3913m/bottom**)**
M106_ 366-1	MSS_6	0°00'N	23°06'W	03.05. 6:40-7:40	**Microstructure**
M106_ 366-2	KPO_1089	0°00.20'N	23°06.80'W	03.05. 7:50-11:40	**Mooring** recovery
M106_ 366-3	MN_16	0°00'N	23°01'W	03.05. 12:50-13:40	**Multinet**
M106_ 366-4	CTD_48	0°00'N	23°01'W	03.05. 13:50-15:10	**CTD/LADCP/PAR** station (1300m)
M106_ 367-1	MN_17	0°10'N	23°00'W	03.05. 16:40-17:40	**Multinet**
M106_ 367-2	CTD_49	0°10'N	23°00'W	03.05. 17:40-18:40	**CTD/LADCP/PAR** station (1300m)
M106_ 367-3	MSS_7	0°10'N	23°00'W	03.05. 18:50-19:40	**Microstructure**
M106_ 368-1	CTD_50	0°10'S	23°00'W	03.05. 22:00-23:20	**CTD/LADCP** station (1300m)
M106_ 368-2	MN_18	0°10'S	23°00'W	03.05. 23:30-0:30	**Multinet**
M106_ 368-3	MSS_8	0°10'S	23°00'W	04.05. 0:40-2:30	**Microstructure**
M106_ 369-1	MN_19	0°00'N	23°01'W	04.05. 3:40-4:40	**Multinet**
M106_ 369-2	CTD_51	0°00'N	23°01'W	04.05. 4:40-7:00	**CTD/LADCP** station (3952m/bottom)
M106_ 370-1	KPO_1125	0°00.20'N	23°06.80'W	04.05. 9:00-12:30	**Mooring** deployment
M106_ 371-1	CTD_52	0°00'N	23°01'W	04.05. 13:10-13:40	**CTD/LADCP/PAR** station (600m)
M106_ 371-2	MSS_9	0°00.3'N	22°59.6'W	04.05. 15:10-16:00	**Microstructure**
M106_ 371-3	CTD_53	0°00'N	23°01'W	04.05. 16:40-18:50	**CTD/LADCP station** (3951m/bottom)
M106_ 372-1	CTD_54	0°20'S	23°00'W	04.05. 21:10-21:30	**CTD/LADCP** station (50m)
M106_ 372-1	CTD_55	0°20'S	23°00'W	04.05. 21:30-0:30	**CTD/LADCP** station (4614m/bottom)
M106_ 372-2	MSS_10	0°20'S	22°59.6'W	05.05. 0:40-2:10	**Microstructure**
M106_ 372-3	CTD_56	0°20'S	23°00'W	05.05. 2:30-5:10	**CTD/LADCP** station (4613m/bottom)

Station No. M106 Ship/Science		**Latitude**	**Longitude**	**Time**	**Work**
M106_ 373-1	CTD_57	0°40'S	23°00'W	05.05. 7:20-9:30	**CTD/LADCP** station (3562m/bottom**)**
M106_ 374-1	CTD_58	1°00'S	23°00'W	05.05. 12:00-14:20	**CTD/LADCP** station (4120m/bottom)
M106_ 374-2	MN_20	1°00'S	23°00'W	05.05. 14:30-15:20	**Multinet**
M106_ 375-1	CTD_59	1°20'S	23°00'W	05.05. 17:40-20:30	**CTD/LADCP** station (4847m/bottom**)**
M106_ 376-1	CTD_60	1°40'S	23°00'W	05.05. 22:50-1:40	**CTD/LADCP** station (4923m/bottom)
M106_ 377-1	CTD_61	2°00'S	23°00'W	06.05. 4:00-7:20	**CTD/LADCP** station (5216m/bottom)
M106_ 378-1	CTD_62	2°20'S	23°00'W	06.05. 9:50-13:10	**CTD/LADCP** station (5124m/bottom**)**
M106_ 379-1	CTD_63	2°40'S	23°00'W	06.05. 15:30-19:00	**CTD/LADCP** station (5630m/bottom)
M106_ 380-1	CTD_64	3°00'S	23°00'W	06.05. 21:30-21:50	**CTD/LADCP** station (120m)
M106_ 380-2	MN_21	3°00'S	23°00'W	06.05. 22:00-22:50	**Multinet**
M106_ 380-3	CTD_65	3°00'S	23°00'W	06.05. 23:40-3:30	**CTD/LADCP** station (5469m/bottom)
M106_ 381-1	CTD_66	3°20'S	23°00'W	07.05. 6:00-9:20	**CTD/LADCP** station (5179m/bottom**)**
M106_ 382-1	CTD_67	3°40'S	23°00'W	07.05. 11:50-15:20	**CTD/LADCP** station (5332m/bottom)
M106_ 383-1	CTD_68	4°00'S	23°00'W	08.05. 0:00-4:10	**CTD/LADCP** station (5822m/bottom)
M106_ 384-1	CTD_69	4°30'S	23°00'W	08.05. 7:30-11:10	**CTD/LADCP** station (5162m/bottom)
M106_ 385-1	CTD_70	5°00'S	23°00'W	08.05. 14:40-17:50	**CTD/LADCP** station (5188m/bottom)
M106_ 385-2	MN_22	5°00'S	23°00'W	08.05. 18:00-18:50	**Multinet**
M106_ 386-1	CTD_71	5°30'S	23°00'W	08.05. 22:20-23:20	**CTD/LADCP** station (1300m)
M106_ 387-1	CTD_72	6°00'S	23°00'W	09.05. 2:40-5:50	**CTD/LADCP** station (5212m/bottom)
M106_ 388-1	CTD_73	6°30'S	23°00'W	09.05. 9:10-10:00	**CTD/LADCP/PAR** station (1300m)
M106_ 389-1	CTD_74	7°00'S	23°00'W	09.05. 13:20-13:40	**CTD/LADCP** station (120m/bottom)
M106_ 389-2	MN_23	7°00'S	23°00'W	09.05. 13:40-14:30	**Multinet**
M106_ 389-3	CTD_75	7°00'S	23°00'W	09.05. 14:40-17:50	**CTD/LADCP** station (5236m/bottom)
M106_ 390-1	CTD_76	7°30'S	23°00'W	09.05. 21:10-22:00	**CTD/LADCP** station (1300m)
M106_ 391-1	CTD_77	8°00'S	23°00'W	10.05. 1:20-5:10	**CTD/LADCP** station (5575m/bottom)
M106_ 392-1	CTD_78	8°30'S	23°00'W	10.05. 8:20-9:50	**CTD/LADCP** station (1300m)

Station No. M106 Ship/Science		**Latitude**	**Longitude**	**Time**	**Work**
M106_ 393-1		11°30'S	32°00'W	12.05. 14:30-15:40	Pressure test of PIES modems, releaser test
M106_ 393-2	CTD_79	11°30'S	32°00'W	12.05. 15:50-19:00	**CTD/LADCP** station (5027m/bottom)
M106_ 394-1	CTD_80	11°30'S	32°27'W	12.05. 22:00-1:00	**CTD/LADCP** station (4759m/bottom)
M106_ 395-1	CTD_81	11°30'S	32°53'W	13.05. 3:40-5:50	**CTD/LADCP** station (3491m/bottom)
M106_ 396-1	CTD_82	11°30'S	33°13'W	13.05. 8:00-10:30	**CTD/LADCP** station (4283m/bottom)
M106_ 397-1	CTD_83	11°30'S	33°33'W	13.05. 11:40-14:40	**CTD/LADCP** station (4963m/bottom)
M106_ 398-1	CTD_84	11°30'S	33°53'W	13.05. 16:40-19:10	**CTD/LADCP** station (4617m/bottom)
		11°30'S	34°13'W		**Start ADCP section**
M106_ 399-1	KPO_1096	10°22.8'S	35°40.8'W	14.05. 7:50-9:40	**Mooring** recovery
M106_ 400-1	KPO_1095	10°16.0'S	35°51.7'W	14.05. 11:20-12:30	**Mooring** recovery
		10°14.2'S	35°54.2'W		**End ADCP section** (70m)
		10°13.677'S	35°52.500'W		**Depth** measurement: 297m
M106_ 401-1	KPO_1134	10°13.58'S	35°52.42'W	14.05. 13:30	**Deployment of PIES** (303m)
		10°14.149'S	35°51.905'W		**Depth** measurement: 484m
M106_ 402-1	KPO_1135	10°13.972'S	35°51.744'W	14.05. 13:50	**Deployment of PIES** (495m)
		10°14.2'S	35°54.2'W		**Start ADCP section** (70m)
M106_ 403-1	CTD_85	10°14.6'S	35°53.6'W	14.05. 14:30-14:50	**CTD/LADCP** station (219m/bottom)
M106_ 403-2	MSS_11	10°14.6'S	35°53.6'W	14.05. 15:00-15:50	**Microstructure**
M106_ 404-1	CTD_86	10°15.3'S	35°52.6'W	14.05. 16:10-16:40	**CTD/LADCP** station (510m/bottom)
M106_ 404-2	MSS_12	10°15.3'S	35°52.6'W	14.05. 16:50-18:30	**Microstructure**
M106_ 405-1	CTD_87	10°16.0'S	35°51.7'W	14.05. 18:50-19:30	**CTD/LADCP** station (899m/bottom)
M106-405-2	MSS_13	10°16.0'S	35°51.7'W	14.05. 19:40-21:10	**Microstructure**
M106-406-1	CTD_88	10°19.5'S	35°46.1'W	14.05. 22:20-23:40	**CTD/LADCP** station (1757m/bottom)
M106_ 406-2	MSS_14	10°19.5'S	35°46.1'W	14.05. 23:50-1:20	**Microstructure**
M106_ 407-1	CTD_89	10°22.8'S	35°40.8'W	15.05. 2:10-3:40	**CTD/LADCP** station (2308m/bottom)
M106_ 407-2	MSS_15	10°22.8'S	35°40.8'W	15.05. 3:40-6:20	**Microstructure**
M106_ 408-1	KPO_1130	10°22.8'S	35°40.8'W	15.05. 8:00-10:20	**Mooring** deployment
M106_ 409-1	KPO_1129	10°16.0'S	35°51.7'W	15.05. 12:30-13:10	**Mooring** deployment
M106_ 410-1	CTD_90	10°27.4'S	35°34.9'W	15.05. 15:30-17:20	**CTD/LADCP** station (2865m/bottom)

Station No. M106 Ship/Science		**Latitude**	**Longitude**	**Time**	**Work**
M106_ 410-2	MSS_16	10°27.4'S	35°34.9'W	15.05. 17:30-19:10	**Microstructure**
M106_ 411-1	CTD_91	10°32.0'S	35°29.3'W	15.05. 20:10-21:00	**CTD/LADCP** station (3205m/bottom)
M106_ 411-2	MSS_17	10°32.0'S	35°29.3'W	15.05. 21:10-21:40	**Microstructure**
M106_ 411-3	CTD_92	10°32.0'S	35°29.3'W	15.05. 20:10-21:00	**CTD/LADCP** station (3205m/bottom)
M106_ 411-4	MSS_18	10°32.0'S	35°29.3'W	15.05. 21:10-21:40	**Microstructure**
M106_ 412-1	CTD_93	10°36.5'S	35°23.6'W	16.05. 2:50-5:00	**CTD/LADCP** station (3512m/bottom)
M106_ 412-2	MSS_19	10°36.5'S	35°23.6'W	16.05. 5:20-7:00	**Microstructure**
M106_ 412-3	KPO_1097	10°36.5'S	35°23.6'W	16.05. 7:20-10:20	**Mooring** recovery
M106- 412-4	KPO_1131	10°36.5'S	35°23.6'W	16.05. 13:40-16:40	**Mooring** deployment
M106_ 413-1	CTD_94	10°41.4'S	35°17.6'W	16.05. 17:50-20:00	**CTD/LADCP** station (3673m/bottom)
M106- 413-2	MSS_20	10°41.4'S	35°17.6'W	16.05. 20:10-21:10	**Microstructure**
M106_ 414-1	CTD_95	10°46.4'S	35°11.6'W	16.05. 22:10-0:30	**CTD/LADCP** station (3868m/bottom)
M106- 414-2	MSS_21	10°46.4'S	35°11.6'W	17.05. 0:40-1:40	**Microstructure**
M106_ 415-1	CTD_96	10°51.4'S	35°05.6'W	17.05. 2:40-5:00	**CTD/LADCP** station (3960m/bottom)
M106_ 415-2	MSS_22	10°51.4'S	35°05.6'W	17.05. 5:10-6:30	**Microstructure**
M106_ 416-1	KPO_1098	10°56.4'S	34°59.6'W	17.05. 7:20-9:50	**Mooring** recovery
M106_ 416-2	CTD_97	10°56.4'S	34°59.6'W	17.05. 10:30-13:00	**CTD/LADCP** station (4096m/bottom)
M106_ 416-3	KPO_1132	10°56.4'S	34°59.6'W	17.05. 14:10-17:50	**Mooring** deployment
M106_ 416-4	MSS_23	10°56.4'S	34°59.6'W	17.05. 18:00-19:40	**Microstructure**
M106_ 417-1	CTD_98	11°07.6'S	34°43.9'W	17.05. 21:50-0:30	**CTD/LADCP** station (4244m/bottom)
M106_ 417-2	MSS_24	11°07.6'S	34°43.9'W	18.05. 0:30-2:10	**Microstructure**
M106_ 418-1	CTD_99	11°18.8'S	34°28.2'W	18.05. 3:20-6:10	**CTD/LADCP** station (4634m/bottom)
M106_ 418-2	MSS_25	11°18.8'S	34°28.2'W	18.05. 6:20-8:00	**Microstructure**
M106_ 419-1	CTD_100	11°30.0'S	34°13.0'W	18.05. 10:10-13:10	**CTD/LADCP** station (4569m/bottom)
M106_ 419-2	MSS_26	11°30.0'S	34°13.0'W	18.05. 13:20-14:40	**Microstructure**
		11°30'S	34°13'W		**Start ADCP section**
M106_ 420-1	CTD_101	10°36.5'S	35°23.6'W	18.05. 23:00-1:20	**CTD/LADCP** station (3525m/bottom)

Station No. M106 Ship/Science		**Latitude**	**Longitude**	**Time**	**Work**
M106_ 421-1	CTD_102	10°32.0'S	35°29.3'W	19.05. 2:20-4:30	**CTD/LADCP** station (3204m/bottom)
		10°14.2'S	35°54.2'W		**End ADCP section** (70m)
M106_ 422-1	CTD_103	5°00'S	31°30'W	20.05. 23:10-2:10	**CTD/LADCP** station (4692m/bottom)
M106_ 422-2	MSS_27	5°00'S	31°30'W	21.05. 2:20-4:00	**Microstructure**
M106_ 423-1	CTD_104	5°07.0'S	32°00.0'W	21.05. 7:00-9:40	**CTD/LADCP** station (4602m/bottom)
M106_ 423-2	MSS_28	5°07.0'S	32°00.0'W	21.05. 9:50-11:20	**Microstructure**
M106_ 424-1	CTD_105	5°12.3'S	32°30.0'W	21.05. 14:20-14:40	**CTD/LADCP** station (120 m)
M106_ 424-2	CTD_106	5°12.3'S	32°30.0'W	21.05. 15:00-17:40	**CTD/LADCP** station (4589m/bottom)
M106_ 424-3	MSS_29	5°12.3'S	32°30.0'W	21.05. 17:50-18:10	**Microstructure**
M106_ 425-1	CTD_107	5°17.7'S	33°00.0'W	21.05. 21:20-0:00	**CTD/LADCP** station (4555m/bottom)
M106_ 425-2	MSS_30	5°17.7'S	33°00.0'W	22.05. 0:10-1:20	**Microstructure**
M106_ 426-1	CTD_108	5°21.7'S	33°25.0'W	22.05. 4:10-6:40	**CTD/LADCP** station (4474m/bottom)
M106_ 426-2	MSS_31	5°21.7'S	33°25.0'W	22.05. 6:50-8:20	**Microstructure**
M106_ 427-1	CTD_109	5°26.6'S	33°50.0'W	22.05. 10:50-13:20	**CTD/LADCP** station (4316m/bottom)
M106_ 427-2	MSS_32	5°26.6'S	33°50.0'W	22.05. 13:20-15:10	**Microstructure**
M106_ 428-1	CTD_110	5°30.2'S	34°10.0'W	22.05. 17:30-17:50	**CTD/LADCP** station (120m)
M106_ 428-2	CTD_111	5°30.2'S	34°10.0'W	22.05. 18:20-20:50	**CTD/LADCP** station (4110m/bottom)
M106_ 428-3	MSS_33	5°30.2'S	34°10.0'W	22.05. 21:00-22:30	**Microstructure**
M106_ 429-1	CTD_112	5°32.7'S	34°24.0'W	23.05. 00:00-3:00	**CTD/LADCP** station (3761m/bottom)
M106_ 429-2	MSS_34	5°32.7'S	34°24.0'W	23.05. 3:00-4:40	**Microstructure**
M106_ 430-1	CTD_113	5°34.8'S	34°36.0'W	23.05. 6:00-8:00	**CTD/LADCP** station (3405m/bottom)
M106_ 430-2	MSS_35	5°34.8'S	34°36.0'W	23.05. 8:10-9:40	**Microstructure**
M106_ 431-1	CTD_114	5°36.6'S	34°46.0'W	23.05. 10:50-12:30	**CTD/LADCP** station (2837m/bottom)
M106- 431-2	MSS_36	5°36.6'S	34°46.0'W	23.05. 12:40-14:00	**Microstructure**
M106_ 432-1	CTD_115	5°38.0'S	34°54.0'W	23.05. 15:00-16:00	**CTD/LADCP** station (1654m/bottom)
M106_ 432-2	MSS_37	5°38.0'S	34°54.0' W	23.05. 16:00-17:50	**Microstructure**
M106_ 432-3	CTD_116	5°38.0'S	34°54.0'W	23.05. 18:30-19:00	**CTD/LADCP** station (600m)

Station No. M106 Ship/Science		Latitude	Longitude	Time	Work
M106_ 433-1	CTD_117	5°38.3'S	34°56.0'W	23.05. 20:00-20:30	**CTD/LADCP** station (740m/bottom)
M106_ 433-2	MSS_38	5°38.3'S	34°56.0'W	23.05. 20:40-21:30	**Microstructure**
M106_ 434-1	CTD_118	5°39.0'S	34°57.6'W	23.05. 22:10-22:30	**CTD/LADCP** station (280m/bottom)
M106_ 434-2	MSS_39	5°39.0'S	34°57.6'W	23.05. 23:40-0:20	**Microstructure**

7.2 Mooring tables

Mooring Operations:

M106 Mooring Recoveries					
Mooring	**New ID**	**Latitude**	**Longitude**	**Deployment Date**	**Recovery Date**
V440-05	KPO_1094	17N 36.4	24W 14.98	25-Oct-12	19-Apr-14
V440-Profiler	KPO_1136	17N 36.27	24W18.82		20-Apr-14
21W 11N	KPO_1091	11N 2.45	21W 13.37	27-Oct-12	24-Apr-14
23.5W 4.5N	KPO_1093	4N 36.00	23W 25.00	31-Oct-12	28-Apr-14
23W 5N	KPO_1090	5N 1.00	23W 0.00	2-Nov-12	29-Apr-14
22.5W 4.5N	KPO_1092	4N 32.00	22W 25.00	1-Nov-12	30-Apr-14
23W 0N	KPO_1089	0N 0.20	23W 6.80	6-Nov-12	3-May-14
K1	KPO_1095	10S 16.00	35W 51.70	6-Jul-13	14-May-14
K2	KPO_1096	10S 22.80	35W 40.80	7-Jul-13	14-May-14
K3	KPO_1097	10S 36.50	35W 23.60	7-Jul-13	16-May-14
K4	KPO_1098	10S 56.40	34W 59.60	8-Jul-13	17-May-14

M106 Mooring Deployments					
Mooring	**New ID**	**Latitude**	**Longitude**	**Deployment Date**	**Recovery Date**
V440-06	KPO_1128	17N 36.35	24W 14.97	20-Apr-14	
21W 11N	KPO_1127	11N 2.45	21W 13.37	25-Apr-14	
23W 5N	KPO_1126	5N 1.23	23W 0.00	29-Apr-14	
23W 0N	KPO_1125	0N 0.00	23W 6.80	4-May-14	
PIES-300m	KPO_1134	10S 13.58	35W 52.42	14-May-14	
PIES-500m	KPO_1135	10S 13.97	35W 51.74	14-May-14	
K1	KPO_1129	10S 16.01	35W 51.69	15-May-14	
K2	KPO_1130	10S 22.87	35W 40.77	15-May-14	
K3	KPO_1131	10S 36.06	35W 24.01	16-May-14	
K4	KPO_1132	10S 55.79	35W 0.07	17-May-14	

Mooring Recoveries:

KPO_1094

Mooring Recovery Cape Verde V440-05					**Notes:**	KPO_1094
Vessel:	Merian		MSM22			
Deployed:	25-Oct		2012			
Vessel:	Meteor		M106			
Recovered:	19-Apr		2014			
Latitude:			17	36,400	N	
Longitude:			24	14,980	W	
Water depth:			3603	Mag Var:	-10,1	

ID	Depth	Instr. type	s/n	Start-up	Remarks
	-230	Devilogics Sat-Trans			
KPO_1094_01	-220	MicroCAT-IM	2809	x	complete and clean record, depth of instrument changed after top element was lost from mooring on 01-Jan-2014,
KPO_1094_02	-205	MicroCAT-IM /p	1717	x	defective pressure sensor, until 20.11.2012
			3753	x	exchange for 1717, since 20.11.2012, clean record, depth of instrument changed after top element was lost from mooring on 01-Jan-2014
KPO_1094_03	45	MicroCAT -IM	7472	x	record only until 11-Jul-2013, clean data
KPO_1094_04	45	Logger (ind. Opt.)	938/18	x	complete and clean record
	47	XEOS Argos Beacon	2264	x	
KPO_1094_05	47	Mini-TD	70	**ready**	complete and clean record
KPO_1094_06	65	MicroCAT	2934	x	complete and clean record
KPO_1094_07	65	Fluorometer	1616	x	complete record
KPO_1094_08	85	MicroCAT	960	x	complete and clean record
KPO_1094_09	120	MicroCAT	1520	x	complete and clean record
KPO_1094_10	120	O2 Logger	939/111	x	complete and clean record
KPO_1094_11	121	SAMI	C0048	x	complete record
KPO_1094_12	148	ADCP WH 300 up	1972	x	complete record, sometimes range problems near the surface
KPO_1094_13	299	MicroCAT /p	2265	x	complete and clean record
KPO_1094_14	399	MicroCAT	1721	x	complete and clean record
KPO_1094_15	599	RCM-8 Temp LR + p	10555	x	complete and clean record
KPO_1094_16	600	MicroCAT	2492	x	partly bad conductivity cell from Dec-2013 to Apr-2014, complete record
KPO_1094_17	850	MicroCAT	381	x	wrong date, record started on 26-Jul-2013
KPO_1094_18	1076	MicroCAT /p	3413	x	defective pressure sensor after 5-Jan-2013, before: drift of ~20dbar
KPO_1094_19	1299	Sediment Trap	900000	**ready**	no bottle turned
KPO_1094_20	1305	RCM-8 Temp LR + p	12005	x	device flooded; no data
KPO_1094_21	1501	MicroCAT /p	2264	x	complete record, drift of pressure sensor (~6dbar during mooring period)
KPO_1094_22	1751	MicroCAT	53	x	complete record, partly bad conductivity cell from 28-Jan-2014 to 07-Feb-2014
KPO_1094_23	1752	Mini-TD	34	**ready**	complete and clean record
KPO_1094_24	1999	MicroCAT	957	x	complete and clean record, data

					transmission errors (152) during reading
KPO_1094_25	2000	Mini-TD	46	**ready**	complete record, continuous 5dbar drift in pressure sensor
KPO_1094_26	2700	MicroCAT	938	**x**	complete and clean record, data transmission errors (120) during reading
KPO_1094_27	2701	Mini-TD	27	**ready**	complete and clean record
KPO_1094_28	2993	Sediment Trap	940060	**ready**	only 3 bottles turned
KPO_1094_29	2999	RCM-8 Temp AR	11622	**x**	complete and clean record
KPO_1094_30	3000	MicroCAT	1162	**x**	complete and clean record
KPO_1094_31	3001	Mini-TD	24	**ready**	complete and clean record
KPO_1094_32	3567	MicroCAT	1320	**x**	complete and clean record, data transmission errors (257) during reading
KPO_1094_33	3568	Mini-TD	20	**ready**	complete and clean record
	3568	Release AR861	1256	Code:	
	3568	Release AR661	235	Code:	

KPO_1136

Mooring Recovery Cape Verde V440-Profiler					**Notes:**	KPO_1136
Vessel:	Meteor	M97				
Deployed:	-May	2013				
Vessel:	Meteor	M106				
Recovered:	20-Apr	2014				
Latitude:		17	36,270	N		
Longitude:		24	18,820	W		
Water depth:		3603	Mag Var:	-10,1		

ID	**Depth**	**Instr. type**	**s/n**	**Start-up**	**Remarks**
KPO_1136_01	137	Devilogics Mooring Winch		**ready**	recovered by Islandia
	162	Release AR861		**x**	recovered by Islandia
	3538	Release AR861	1256	Code:	
	3538	Release AR661	235	Code:	

KPO_1091

Mooring Recovery Equatorial Atlantic 21W 11N					**Notes:**	KPO_1091
Vessel:	Merian	MSM22				
Deployed:	27-Oct	2012				
Vessel:	Meteor	M106				
Recovered:	24-Apr	2014				
Latitude:		11	2,216	N		
Longitude:		21	13,290	W		
Water depth:		5072	Mag Var:	-10,4		

ID	**Depth**	**Instr. type**	**s/n**	**Start-up**	**Remarks**
		Argos SMM 2000	12619		
KPO_1091_01	100	Mini-TD	71	**ready**	complete and clean record
KPO_1091_02	101	O2 Logger	349	**x**	complete and clean record
KPO_1091_03	101	MicroCAT /p	3411	**x**	complete and clean record
KPO_1091_04	203	O2 Logger	941	**x**	complete and clean record (0.75% of data missing throughout mooring period)
KPO_1091_05	203	MicroCAT	2260	**x**	complete and clean record
KPO_1091_06	298	O2 Logger	942	**x**	complete and clean record
KPO_1091_07	298	MicroCAT /p	2269	**x**	complete record, bad conductivity cell in Sep-2013 for about one

					week (1.3% of data)
KPO_1091_08	400	O2 Logger	1140	x	complete and clean record
KPO_1091_09	400	MicroCAT	2617	x	complete and clean record
KPO_1091_10	502	O2 Logger	1143	x	complete and clean record (0.75% of data missing in several intervals throughout mooring period)
KPO_1091_11	502	MicroCAT	2618	x	complete and clean record
KPO_1091_12	597	O2 Logger	1461	x	complete and clean record
KPO_1091_13	597	MicroCAT /p	2485	x	complete and clean record
KPO_1091_14	699	O2 Logger	1464	x	complete and clean record (half a day of data missing at 15-May-2013)
KPO_1091_15	699	MicroCAT	2248	x	complete and clean record
KPO_1091_16	801	ADCP LR up	2627	x	complete and clean record
KPO_1091_17	803	O2 Logger	1471	x	complete and clean record
KPO_1091_18	803	MicroCAT	2472	x	complete and clean record
	4221	Release AR861	1549	Code:	
	4221	Release AR661	642	Code:	

KPO_1093

Mooring Recovery Equatorial Atlantic 23,5W 4.5N				**Notes:**	KPO_1093
Vessel:	Merian	MSM22			
Deployed:	31-Oct	2012			
Vessel:	Meteor	M106			
Recovered:	28-Apr	2014			
Latitude:		4	36,000	N	
Longitude:		23	25,000	W	
Water depth:		4370	Mag Var:	-13,6	

ID	Depth	Instr. type	s/n	Start-up	Remarks
		Argos SMM 2000	2267		
KPO_1093_01	101	Mini-TD	64	**ready**	complete and clean record
KPO_1093_02	102	O2 Logger	1144	x	complete and clean record
KPO_1093_03	102	MicroCAT /p	6863	x	complete and clean record
KPO_1093_04	204	O2 Logger	1468	x	complete and clean record
KPO_1093_05	204	MicroCAT	2251	x	complete record, bad conductivity cell from Jul-2013 to Oct-2013
KPO_1093_06	299	O2 Logger	1467	x	complete and clean record
KPO_1093_07	299	MicroCAT /p	6857	x	complete and clean record
KPO_1093_08	401	O2 Logger	944	x	1.3% of data missing in several intervals throughout mooring period
KPO_1093_09	401	MicroCAT	2250	x	complete and clean record
KPO_1093_10	503	O2 Logger	1138	x	complete and clean record
KPO_1093_11	503	MicroCAT	2246	x	complete and clean record
KPO_1093_12	598	O2 Logger	1469	x	complete and clean record
KPO_1093_13	598	MicroCAT /p	6856	x	complete and clean record
KPO_1093_14	700	O2 Logger	1462	x	complete and clean record
KPO_1093_15	700	MicroCAT	2245	x	complete and clean record
KPO_1093_16	802	ADCP LR up	17570	x	complete and clean record
KPO_1093_17	804	O2 Logger	1133	x	complete and clean record
KPO_1093_18	804	MicroCAT	1550	x	complete and clean record
	3921	Release AR661	221	Code:	
	3921	Release AR861	1548	Code:	

KPO_1090

Mooring Recovery Equatorial Atlantic 23W 5N					**Notes:**	KPO_1090
Vessel:	Merian	MSM22				
Deployed:	27-Oct	2012				
Vessel:	Meteor	M106				
Recovered:	29-Apr	2014				
Latitude:		5	1,000	N		
Longitude:		23	0,000	W		
Water depth:		4210	Mag Var:	-13,3		

ID	Depth	Instr. type	s/n	Start-up	Remarks
		Argos SMM 2000	12617		
KPO_1090_01	97	Mini-TD	66	**ready**	complete and clean record
KPO_1090_02	99	O2 Logger	215	**x**	complete and clean record
KPO_1090_03	99	MicroCAT /p	6859	**x**	complete and clean record
KPO_1090_04	200	O2 Logger	1134	**x**	complete and clean record
KPO_1090_05	200	MicroCAT	1682	**x**	complete and clean record
KPO_1090_06	296	O2 Logger	1074	**x**	complete and clean record
KPO_1090_07	296	MicroCAT /p	6860	**x**	complete and clean record (drift of pressure sensor by about 2dbar)
KPO_1090_08	398	O2 Logger	206	**x**	complete and clean record
KPO_1090_09	398	MicroCAT	8945	**x**	complete and clean record
KPO_1090_10	500	O2 Logger	1072	**x**	no data – optode already died during day of deployment
KPO_1090_11	500	MicroCAT	8946	**x**	complete and clean record
KPO_1090_12	595	O2 Logger	148	**x**	complete and clean record
KPO_1090_13	595	MicroCAT /p	6861	**x**	complete and clean record
KPO_1090_14	697	O2 Logger	216	**x**	complete and clean record
KPO_1090_15	697	MicroCAT	6779	**x**	complete and clean record
KPO_1090_16	799	ADCP LR up	2395	**x**	complete and clean record
KPO_1090_17	801	O2 Logger	1135	**x**	complete and clean record
KPO_1090_18	801	MicroCAT	8947	**x**	complete and clean record
	3592	Release RT861	555	Code:	
	3592	Release RT661	28	Code:	

KPO_1092

Mooring Recovery Equatorial Atlantic 22,5W 4.5N					**Notes:**	KPO_1092
Vessel:	Merian	MSM22				
Deployed:	1-Nov	2012				
Vessel:	Meteor	M106				
Recovered:	30-Apr	2014				
Latitude:		4	32,000	N		
Longitude:		22	25,000	W		
Water depth:		3650	Mag Var:	-13,2		

ID	Depth	Instr. type	s/n	Start-up	Remarks
		Argos SMM 2000	2255		
KPO_1092_01	99	Mini-TD	72	**ready**	defective pressure sensor since 24-Mar-2013
KPO_1092_02	100	O2 Logger	1470	**x**	4% of data missing in several intervals throughout mooring period
KPO_1092_03	100	MicroCAT /p	6854	**x**	complete and clean record (drift of pressure sensor by about 2dbar)
KPO_1092_04	202	O2 Logger	375	**x**	complete and clean record
KPO_1092_05	202	MicroCAT	1599	**x**	complete and clean record
KPO_1092_06	297	O2 Logger	1465	**x**	complete and clean record
KPO_1092_07	297	MicroCAT /p	6855	**x**	complete and clean record (drift of

					pressure sensor by about 2dbar)
KPO_1092_08	399	O2 Logger	940	x	complete and clean record
KPO_1092_09	399	MicroCAT	2048	x	complete and clean record
KPO_1092_10	501	O2 Logger	219	x	complete and clean record
KPO_1092_11	501	MicroCAT	2249	x	complete and clean record
KPO_1092_12	596	O2 Logger	214	x	defective oxygen sensor after 09-May-2013, defective temperature sensor after 15-Sep-2013 (65%/42% of O2/T data missing)
KPO_1092_13	596	MicroCAT /p	6858	x	complete and clean record, drift in pressure sensor by about 10dbar
KPO_1092_14	698	O2 Logger	1463	x	complete and clean record
KPO_1092_15	698	MicroCAT	2279	x	complete and clean record
KPO_1092_16	800	ADCP LR up	17590	x	complete and clean record
KPO_1092_17	802	O2 Logger	379	x	complete and clean record
KPO_1092_18	802	MicroCAT	3144	x	complete and clean record
	2632	Release AR861	107	Code:	
	2632	Release AR661	460	Code:	

KPO_1089

Mooring Recovery Equatorial Atlantic 23W 0N					**Notes:** KPO_1089
Vessel:	Merian	MSM22			
Deployed:	6-Nov	2012			
Vessel:	Meteor	M106			
Recovered:	3-May	2014			
Latitude:		0	0,2	N	
Longitude:		23	6,8	W	
Water depth:		3930	Mag Var:	-15,4	
ID	**Depth**	**Instr. type**	**s/n**	**Start-up**	**Remarks**
		Argos SMM 2000	7372		
KPO_1089_01	215	ADCP up	8237	x	complete and clean record
KPO_1089_02	215	Mini-TD	58	**ready**	complete and clean record
KPO_1089_03	218	ADCP LR dn	12538	x	complete and clean record
KPO_1089_04	300	O2 Logger	147	x	complete and clean record
KPO_1089_05	300	MicroCAT	2247	x	complete and clean record
KPO_1089_06	506	O2 Logger	1069	x	complete and clean record
KPO_1089_07	506	MicroCAT	7417	x	complete and clean record
KPO_1089_08	759	Mini-TD	48	x	complete and clean record
KPO_1089_09	842	Argonaut	329	x	complete and clean record
KPO_1089_10	927	RCM-8	10659	x	complete and clean record
KPO_1089_11	980	RCM-8 /p	10658	x	missing rotor counts, pressure sensor broken
KPO_1089_12	1000	M-CTD MMP	11617	x	31,8 % of data missing in several intervals throughout mooring period
	3614	Release AR861	1255	Code:	
	3614	Release RT661	31	Code:	

KPO_1095

Mooring Recovery NBUC 11°S Array mooring K1					**Notes:** KPO_1095
Vessel:	Meteor	M98			
Deployed:	6-Jul	2013			
Vessel:	Meteor	M106			
Recovered:	14-May	2014			
Latitude:		10	16.000	S	
Longitude:		35	51.700	W	

Water depth:			900	Mag Var:	-22.7	
ID	**Depth**	**Instr. type**		**s/n**	**Start-up**	**Remarks**
		Watchdog		2263	**x**	
KPO_1095_01	150	Mini-TD /p		69	**x**	lost during mooring period
KPO_1095_02	154	MicroCAT /p		6862	**x**	complete and clean record
KPO_1095_03	347	MicroCAT		1282	**x**	complete and clean record
KPO_1095_04	499	ADCP LR up /p		12530	**x**	complete record, high pitch/roll affect range
KPO_1095_05	502	MicroCAT		921	**x**	complete and clean record
KPO_1095_06	643	MicroCAT		933	**x**	complete and clean record
KPO_1095_07	647	NORTEK /p		8409	**x**	complete and clean record until 25/04/2014, after reduced sampling rate due due low battery
KPO_1095_08	874	MicroCAT		1288	**x**	complete and clean record
	875	Release AR661		839	Code:	
	875	Release AR861		95	Code:	

KPO_1096

Mooring Recovery NBUC 11°S Array mooring K2						**Notes:**	KPO_1096
Vessel:	Meteor		M98				
Deployed:	7-Jul		2013				
Vessel:	Meteor		M106				
Recovered:	14-May		2014				
Latitude:			10	22.800	S		
Longitude:			35	40.800	W		
Water depth:			2320	Mag Var:	-22.7		

ID	**Depth**	**Instr. type**	**s/n**	**Start-up**	**Remarks**
		Watchdog	15173		
KPO_1096_01	139	Mini-TD /p	57	**ready**	complete and clean record
KPO_1096_02	143	MicroCAT /p	2484	**x**	complete and clean record
KPO_1096_03	345	MicroCAT	935	**x**	complete and clean record
KPO_1096_04	506	ADCP LR /p	2330	**x**	complete record, high pitch/roll affect range
KPO_1096_05	650	MicroCAT	929	**x**	complete and clean record
KPO_1096_06	653	Argonaut	304	**x**	complete and clean record
KPO_1096_07	890	RCM-11 LR	293	**x**	complete and clean record
KPO_1096_08	1197	MicroCAT	934	**x**	complete and clean record
KPO_1096_09	1401	RCM-8 LR /p	00094	**x**	complete and clean record
KPO_1096_10	1497	MicroCAT	780	**x**	device lost during recovery
KPO_1096_11	1904	MicroCAT	1281	**x**	complete and clean record
KPO_1096_12	1905	Argonaut	144	**x**	complete and clean record
KPO_1096_13	2292	MicroCAT	1319	**x**	complete and clean record
	2294	Release AR661	635	Code:	
	2294	Release AR861	271	Code:	

KPO_1097

Mooring Recovery NBUC 11°S Array mooring K3						**Notes:**	KPO_1097
Vessel:	Meteor		M98				
Deployed:	7-Jul		2013				
Vessel:	Meteor		M106				
Recovered:	16-May		2014				
Latitude:			10	36.500	S		
Longitude:			35	23.600	W		
Water depth:			3520	Mag Var:	-22.7		
ID	**Depth**	**Instr. type**		**s/n**	**Start-up**	**Remarks**	

		SMM 2000	7373		
KPO_1097_01	347	ADCP up	623	x	complete and clean record
KPO_1097_02	347	Mini-TD	23	**ready**	complete and clean record
KPO_1097_03	351	MicroCAT /p	10609	x	complete and clean record
KPO_1097_04	476	RCM-8 LR	09346	x	complete and clean record
KPO_1097_05	652	RCM-11 LR	441	x	complete and clean record
KPO_1097_06	653	MicroCAT	3196	x	complete and clean record
KPO_1097_07	898	Argonaut	187	x	complete and clean record
KPO_1097_08	1396	NORTEK /p	8387	x	lost during mooring recovery
KPO_1097_09	1895	RCM-8 LR/AR	9732	x	complete and clean record
KPO_1097_10	1897	MicroCAT	939	x	complete and clean record
KPO_1097_11	2404	RCM-8 /p LR	08411	x	complete record, strange peaks in pressure record
KPO_1097_12	2798	MicroCAT	278	x	complete and clean record
KPO_1097_13	3004	Argonaut	294	x	complete and clean record
KPO_1097_14	3400	MicroCAT	910	x	complete and clean record
	3403	Release AR661	659	Code:	
	3403	Release AR861	1648	Code:	

KPO_1098

Mooring Recovery NBUC 11°S Array mooring offshore K4				**Notes:**	KPO_1098
Vessel:	Meteor	M98			
Deployed:	8-Jul	2013			
Vessel:	Meteor	M106			
Recovered:	16-May	2014			
Latitude:		10	56.400	S	
Longitude:		34	59.600	W	
Water depth:		3520	Mag Var:	-22.7	

ID	**Depth**	**Instr. type**	**s/n**	**Start-up**	**Remarks**
		SMM 2000	11460		
KPO_1098_01	343	ADCP up	589	x	complete and clean record, minor range
KPO_1098_02	345	Mini-TD	47	**ready**	complete and clean record
KPO_1098_03	345	MicroCAT	1286	x	complete and clean record
KPO_1098_04	470	RCM-11 LR	477	x	complete and clean record
KPO_1098_05	645	RCM-8 LR	8365	x	complete and clean record
KPO_1098_06	647	MicroCAT /p	10610	x	complete and clean record
KPO_1098_07	903	RCM-8 LR	10554	x	complete and clean record
KPO_1098_08	1907	RCM-8 AR/p	10776	x	complete record, but problems with the pressure sensor in first half of record
KPO_1098_09	1908	MicroCAT	0055	x	complete and clean record
	3803	Release AR661	220	Code:	
	3803	Release AR861	975	Code:	

Mooring Deployments:

KPO_1128

Mooring Deployment Cape Verde V440-06				**Notes:**	KPO_1128
Vessel:	Meteor	M106			
Deployed:	20-Apr	2014			
Vessel:					
Recovered:					
Latitude:		17	36,354	N	

Longitude:			24	14,976	W
Water depth:			3570	Mag Var:	-10,0

ID	Depth	Instr. type	s/n	Start-up	Remarks
	-233	Devilogics Sat-Trans	PE001	**ready**	transmitting
KPO_1128_01	-221	MicroCAT-IM	10696	**x**	
KPO_1128_02	-206	MicroCAT-IM /p	2712	**x**	
KPO_1128_03	43	MicroCAT-IM	961	**x**	
KPO_1128_04	43	O2 Logger (ind. Opt.)	385	**x**	
	50	XEOS Argos Beacon	5481	**x**	
KPO_1128_05	50	Mini-TD	67	**ready**	
KPO_1128_06	71	MicroCAT	952	**x**	
KPO_1128_07	71	Fluorometer	2856	**x**	
KPO_1128_08	91	MicroCAT	1583	**x**	
KPO_1128_09	120	MicroCAT	1268	**x**	
KPO_1128_10	120	O2 Logger	937	**x**	
KPO_1128_11	121	SAMI-2	67	**x**	
KPO_1128_12	161	MicroCAT	1269	**x**	
KPO_1128_13	201	MicroCAT	1285	**x**	
KPO_1128_14	301	ADCP QM 150 up	14910	**x**	
KPO_1128_15	403	MicroCAT-IM	3415	**x**	
KPO_1128_16	599	Acoustic Recorder	---	**ready**	
KPO_1128_17	616	Aquadop up	26209-36	**x**	
KPO_1128_18	755	MicroCAT	10709	**x**	
KPO_1128_19	1106	MicroCAT-IM /p	2488	**x**	
KPO_1128_20	1304	Sediment Trap	910015	**ready**	bottle 9 & 16 missing
KPO_1128_21	1316	Aquadop down	26209-34	**x**	
KPO_1128_22	1500	MicroCAT-IM /p	3752	**x**	
KPO_1128_23	3014	Aquadop down	26209-13	**x**	
KPO_1128_24	3548	MicroCAT-IM /p	10660	**x**	
	3604	Release AR861	1256	Code:	0855
	3604	Release AR861	1772	Code:	0A55

KPO_1127

Mooring Deployment Equatorial Atlantic 21W 11N				**Notes:**	KPO_1127
Vessel:	Meteor	M106			
Deployed:	24-Apr	2014			
Vessel:					
Recovered:					
Latitude:		11	2,456	N	
Longitude:		21	13,375	W	
Water depth:		5079	Mag Var:	-10,5	

ID	Depth	Instr. type	s/n	Start-up	Remarks
	96	Argos SMM 2000	12619	**ready**	
KPO_1127_01	96	Mini-TD	70	**ready**	
KPO_1127_02	97	O2 Logger	942	**x**	
KPO_1127_03	97	MicroCAT	2265	**x**	
KPO_1127_04	199	O2 Logger	1140	**x**	
KPO_1127_05	199	MicroCAT	10693	**x**	
KPO_1127_06	294	O2 Logger	1461	**x**	
KPO_1127_07	294	MicroCAT	10694	**x**	
KPO_1127_08	396	O2 Logger	938	**x**	
KPO_1127_09	396	MicroCAT	10695	**x**	
KPO_1127_10	498	O2 Logger	1464	**x**	
KPO_1127_11	498	MicroCAT	10710	**x**	
KPO_1127_12	594	O2 Logger	348	**x**	

KPO_1127_13	594	MicroCAT	10711	x		
KPO_1127_14	696	O2 Logger	1471	x		
KPO_1127_15	696	MicroCAT	10712	x		
KPO_1127_16	798	ADCP LR up	3174	x		
KPO_1127_17	803	O2 Logger	1143	x		
KPO_1127_18	803	MicroCAT	10713	x		
	5070	Release AR861	1549	Code:	0A55	
	5070	Release AR661	1771	Code:	0A55	

KPO_1126

Mooring Deployment Equatorial Atlantic 23W 5N					**Notes:**	KPO_1126
Vessel:	Meteor	M106				
Deployed:	29-Apr	2014				
Vessel:						
Recovered:						
Latitude:		5	1,236	N		
Longitude:		23	0,006	W		
Water depth:		4206	Mag Var:	-13,6		
ID	**Depth**	**Instr. type**	**s/n**	**Start-up**	**Remarks**	
	97	Argos SMM 2000	12617	**ready**		
KPO_1126_01	97	Mini-TD	34	**ready**		
KPO_1126_02	99	O2 Logger	944	x	loggerboard swapped and reprogrammed	
KPO_1126_03	99	MicroCAT	3753	x		
KPO_1126_04	200	O2 Logger	1138	x		
KPO_1126_05	200	MicroCAT	2934	x		
KPO_1126_06	296	O2 Logger	1467	x		
KPO_1126_07	296	MicroCAT	2263	x		
KPO_1126_08	398	O2 Logger	1133	x		
KPO_1126_09	398	MicroCAT	2492	x		
KPO_1126_10	500	O2 Logger	1468	x		
KPO_1126_11	500	MicroCAT	2809	x		
KPO_1126_12	595	O2 Logger	1144	x		
KPO_1126_13	595	MicroCAT	3411	x		
KPO_1126_14	697	O2 Logger	1469	x		
KPO_1126_15	697	MicroCAT	2617	x		
KPO_1126_16	799	ADCP LR up	2627	x		
KPO_1126_17	801	O2 Logger	1462	x		
KPO_1126_18	801	MicroCAT	2248	x		
	3592	Release RT861	555	Code:	0255	
	3592	Release RT661	28	Code:	5024	

KPO_1125

Mooring Deployment Equatorial Atlantic 23W 0N					**Notes:**	KPO_1125
Vessel:	Meteor	M106				
Deployed:	4-May	2014				
Vessel:						
Recovered:						
Latitude:		0	0,000	N		
Longitude:		23	6,800	W		
Water depth:		3908	Mag Var:	-15,7		
ID	**Depth**	**Instr. type**	**s/n**	**Start-up**	**Remarks**	
	214	Argos SMM 2000	7372	**ready**		
KPO_1125_01	214	ADCP QM up	14911	x		
KPO_1125_02	214	Mini-TD	27	**ready**		

KPO_1125_03	218	ADCP LR dn	2395	x		
KPO_1125_04	300	O2 Logger	1134	x		
KPO_1125_05	300	MicroCAT	2472	x		
KPO_1125_06	506	O2 Logger	1135	x		
KPO_1125_07	506	MicroCAT	2485	x		
KPO_1125_08	831	Argonaut	D038	x		
KPO_1125_09	906	Aquadopp	26209-20	x		
KPO_1125_10	983	RCM-8 /p	6122	x		
KPO_1125_11	1000	M-CTD MMP	12201	x		
	3634	Release AR861	1548	Code:	0A55	
	3634	Release RT661	31	Code:	5039	

KPO_1134

Mooring Deployment PIES Brasil 300m					**Notes:**	KPO_1134
Vessel:	Meteor	M106				
Deployed:	14-May	2014				
Vessel:						
Recovered:						
Latitude:		10	13,580	S		
Longitude:		35	52,420	W		
Water depth:		301	Mag Var:	-23,3		
ID	**Depth**	**Instr. type**	**s/n**	**Start-up**	**Remarks**	
KPO_1134_01	300	PIES	320	x	Telem:66, XPND:70, BEACON:74, RELEASE:0	
KPO_1134_02	300	Develogic Modem	3070	x	Adress: 0x0031	
				Code:		
				Code:		

KPO_1135

Mooring Deployment PIES Brasil 500m					**Notes:**	KPO_1135
Vessel:	Meteor	M106				
Deployed:	14-May	2014				
Vessel:						
Recovered:						
Latitude:		10	13,970	S		
Longitude:		35	51,740	W		
Water depth:		494	Mag Var:	-23,3		
ID	**Depth**	**Instr. type**	**s/n**	**Start-up**	**Remarks**	
KPO_1135_01	500	PIES	319	x	Telem:65, XPND:69, BEACON:73, RELEASE:63	
KPO_1135_02	500	Develogic Modem	3065	x	Adress: 0x0021	
				Code:		
				Code:		

KPO_1129

Mooring Deployment NBUC 11°S Array mooring K1					**Notes:**	KPO_1129
Vessel:	Meteor	M106				
Deployed:	15-May	2014				
Vessel:						
Recovered:						
Latitude:		10	16,010	S		
Longitude:		35	51,690	W		
Water depth:		892	Mag Var:	-23,3		
ID	**Depth**	**Instr. type**	**s/n**	**Start-up**	**Remarks**	
	500	Argos SMM 2000	2267	**ready**		
KPO_1129_01	500	ADCP LR up	17570	x		

KPO_1129_02	503	MicroCAT /p	6859	x	
KPO_1129_03	648	MicroCAT	2048	x	
KPO_1129_04	649	Aquadopp	P26209-24	x	
KPO_1129_05	874	MicroCAT	2245	x	
	875	Release AR861	1642	Code:	0A55
	875	Release AR861	095	Code:	0455

KPO_1130

Mooring Deployment NBUC 11°S Array mooring K2					**Notes:**	KPO_1130
Vessel:	Meteor	M106				
Deployed:	15-May	2014				
Vessel:						
Recovered:						
Latitude:		10	22,870	S		
Longitude:		35	40,770	W		
Water depth:		2139	Mag Var:	-23,3		

ID	**Depth**	**Instr. type**	**s/n**	**Start-up ready**	**Remarks**
	505	Argos SMM 2000	2255		
KPO_1130_01	505	ADCP LR up	12538	x	
KPO_1130_02	508	MicroCAT /p	6861	x	
KPO_1130_03	654	MicroCAT	53	x	
KPO_1130_04	655	Aquadopp	P26209-21	x	
KPO_1130_05	890	RCM-8 /p	8349	x	
KPO_1130_06	891	Aquadopp	P26209-28	x	
KPO_1130_07	1197	MicroCAT	957	x	
KPO_1130_08	1402	Aquadopp	P26209-33	x	
KPO_1130_09	1494	MicroCAT	2246	x	
KPO_1130_10	1904	MicroCAT	3144	x	
KPO_1130_11	1905	Argonaut	D329	x	
KPO_1130_12	2289	MicroCAT	1599	x	
	2294	Release AR861	1643	Code:	0A55
	2294	Release AR861	271	Code:	1455

KPO_1131

Mooring Deployment NBUC 11°S Array mooring K3					**Notes:**	KPO_1131
Vessel:	Meteor	M106				
Deployed:	16-May	2014				
Vessel:						
Recovered:						
Latitude:		10	36,060	S		
Longitude:		35	24,010	W		
Water depth:		3333	Mag Var:	-23,3		

ID	**Depth**	**Instr. type**	**s/n**	**Start-up ready**	**Remarks**
	497	Argos XEOS	5506		
KPO_1131_01	497	ADCP LR up	12530	x	
KPO_1131_02	500	MicroCAT /p	6856	x	
KPO_1131_03	652	MicroCAT	2249	x	
KPO_1131_04	656	Aquadopp	P26209-18	x	
KPO_1131_05	901	Aquadopp	P26209-19	x	
KPO_1131_06	1398	RCM-8 /p	9933	x	
KPO_1131_07	1896	RCM-8 /p	11348	x	
KPO_1131_08	1898	MicroCAT	2251	x	
KPO_1131_09	1899	Aquadopp	P26209-27	x	
KPO_1131_10	2406	Aquadopp	P26209-02	x	

KPO_1131_11	2799	MicroCAT	2250	**x**	
KPO_1131_12	3004	Aquadopp	P26209-16	**x**	
KPO_1131_13	3397	MicroCAT	381	**x**	
	3403	Release AR861	1648	Code:	0A55
	3403	Release AR861	1645	Code:	0A55

KPO_1132

Mooring Deployment NBUC 11°S Array mooring offshore K4				**Notes:**	KPO_1132
Vessel:	Meteor	M106			
Deployed:	17-May	2014			
Vessel:					
Recovered:					
Latitude:		10	55,7900	S	
Longitude:		35	0,070	W	
Water depth:		4008	Mag Var:	-23,3	

ID	**Depth**	**Instr. type**	**s/n**	**Start-up ready**	**Remarks**
	499	Argos XEOS	2264		
KPO_1132_01	499	ADCP LR up	17590	**x**	
KPO_1132_02	502	MicroCAT /p	6857	**x**	
KPO_1132_03	647	MicroCAT	2279	**x**	
KPO_1132_04	648	Argonaut	D304	**x**	
KPO_1132_05	904	RCM-8 /p	12004	**x**	
KPO_1132_06	905	Aquadopp	P26209-15	**x**	
KPO_1132_07	1908	RCM-8 /p	10659	**x**	
KPO_1132_08	1909	MicroCAT	1320	**x**	
KPO_1132_09	1910	Aquadopp	P26209-14	**x**	
	3854	Release AR861	1644	Code:	0A55
	3854	Release AR861	975	Code:	1855

7.3 CTD station list

Station	CTD cast	Date	Time	Latitude	Longitude	max. d [m]	bottom [m]	Additional measurements										
M1060/322-2	001	19.04.14	22:40	17° 36.03' N	24° 15.05' W	3455	3598	L	U									
M1060/322-3	002	20.04.14	02:47	17° 35.98' N	24° 15.06' W	999	3599	L	U									
M1060/322-5	003	20.04.14	05:46	17° 36.01' N	24° 15.10' W	3588	3599	L	U		1	2	3	4			7	
M1060/326-1	004	21.04.14	21:31	15° 00.04' N	23° 00.10' W	103	2680	L	U						5		7	
M1060/326-3	005	21.04.14	23:19	15° 00.89' N	23° 00.10' W	2735	2738	L	U		1	2	3	4				8
M1060/327-1	006	22.04.14	04:46	14° 29.96' N	23° 00.07' W	1298	4080	L	U									
M1060/328-1	007	22.04.14	08:37	13° 59.91' N	23° 00.02' W	4303	4319	L	U		1	2	3	4				
M1060/329-1	008	22.04.14	15:03	13° 29.96' N	23° 00.01' W	1298	4530		U									
M1060/330-1	009	22.04.14	19:02	12° 59.94' N	23° 00.04' W	4730	4739		U		1	2	3	4			7	
M1060/331-1	010	23.04.14	02:02	12° 29.95' N	23° 00.00' W	1301	4910		U									
M1060/332-1	011	23.04.14	05:45	11° 59.94' N	23° 00.00' W	5004	5045		U		1	2	3	4				8
M1060/333-1	012	23.04.14	11:28	11° 29.92' N	23° 00.00' W	1299	5110		U									
M1060/334-2	013	23.04.14	18:30	10° 59.98' N	23° 00.08' W	5133	5150		U		1	2	3	4				
M1060/335-1	014	24.04.14	02:15	10° 30.00' N	23° 00.04' W	1297	5180		U									
M1060/337-2	015	24.04.14	19:24	11° 02.16' N	21° 13.41' W	5050	5070	L	U		1	2	3	4		6		
M1060/337-4	016	24.04.14	23:54	11° 02.16' N	21° 13.41' W	1300	5070	L	U									
M1060/337-9	017	25.04.14	15:15	11° 00.59' N	21° 12.45' W	1301	5070		U									
M1060/338-1	018	26.04.14	06:30	10° 00.03' N	23° 00.00' W	5022	5032	L			1	2	3	4		6		
M1060/339-1	019	26.04.14	12:16	09° 29.97' N	23° 00.01' W	1297	4630	L	U									
M1060/340-2	020	26.04.14	17:05	08° 59.97' N	23° 00.06' W	4882	4892	L	U		1	2	3	4		6		8
M1060/341-1	021	26.04.14	23:20	08° 29.98' N	23° 00.01' W	1324	4780	L	U									

Station	CTD cast	Date	Time	Latitude	Longitude	max. d [m]	bottom [m]	Additional measurements										
M1060/342-1	022	27.04.14	03:17	07° 59.99’ N	23° 00.00’ W	4402	4410	L	U		1	2	3	4		6		
M1060/343-1	023	27.04.14	08:59	07° 29.99’ N	23° 00.03’ W	1300	4380	L	U	P								
M1060/344-1	024	27.04.14	13:09	06° 57.98’ N	22° 58.71’ W	1305	1314	L	U	P	1	2	3	4		6	7	
M1060/345-1	025	27.04.14	17:34	06° 34.01’ N	22° 55.50’ W	3341	3354	L	U									
M1060/347-1	026	28.04.14	02:53	05° 59.97’ N	23° 00.00’ W	102	4090	L	U								7	
M1060/347-2	027	28.04.14	03:34	05° 59.95’ N	22° 59.99’ W	4083	4092	L	U		1	2	3	4				8
M1060/349-1	028	28.04.14	09:50	05° 29.97’ N	22° 59.99’ W	1299	4225	L	U	P								
M1060/351-1	029	28.04.14	21:31	04° 29.98’ N	23° 00.00’ W	4113	4121	L	U									
M1060/352-2	030	29.04.14	07:02	04° 59.05’ N	22° 59.96’ W	1298	4200	L	U									
M1060/352-4	031	29.04.14	12:51	05° 00.98’ N	22° 59.98’ W	1302	4200	L	U	P					5			
M1060/352-7	032	29.04.14	20:34	05° 01.51’ N	22° 58.98’ W	1352	4202	L	U									
M1060/352-8	033	29.04.14	22:58	05° 01.51’ N	22° 58.98’ W	4191	4202	L	U		1	2	3	4		6	7	
M1060/354-1	034	30.04.14	16:17	03° 59.98’ N	23° 00.01’ W	4202	4214	L	U		1	2	3	4			7	
M1060/355-1	035	30.04.14	21:12	03° 39.98’ N	22° 59.99’ W	4430	4439	L	U						5			
M1060/356-1	036	01.05.14	02:45	03° 19.98’ N	22° 59.99’ W	4146	4156	L	U									
M1060/357-1	037	01.05.14	07:44	03° 00.07’ N	22° 59.99’ W	4631	4643	L	U		1	2	3	4		6		8
M1060/357-3	038	01.05.14	12:22	03° 00.07’ N	22° 59.99’ W	201	4643		U	P							7	
M1060/358-1	039	01.05.14	15:07	02° 40.03’ N	23° 00.02’ W	4691	4702	L	U									
M1060/359-1	040	01.05.14	20:05	02° 20.02’ N	23° 00.01’ W	4269	4280	L	U						5			
M1060/360-1	041	02.05.14	00:57	02° 00.08’ N	23° 00.01’ W	122	4330		U								7	
M1060/360-2	042	02.05.14	01:40	02° 00.08’ N	23° 00.01’ W	4321	4330	L	U		1	2	3	4	5			
M1060/361-1	043	02.05.14	06:36	01° 40.07’ N	23° 00.06’ W	4106	4118	L	U									
M1060/362-1	044	02.05.14	11:30	01° 20.02’ N	23° 00.03’ W	4709	4719	L	U									
M1060/363-2	045	02.05.14	18:12	01° 00.03’ N	23° 00.07’ W	3210	3222	L	U		1	2		4			7	
M1060/364-1	046	02.05.14	22:27	00° 39.99’ N	23° 00.02’ W	3886	3900	L	U									
M1060/365-1	047	03.05.14	03:07	00° 20.03’ N	23° 00.01’ W	3906	3916	L	U									
M1060/366-4	048	03.05.14	14:44	00° 00.09’ N	23° 00.94’ W	1302	3950	L	U	P					5			
M1060/367-2	049	03.05.14	18:43	00° 10.05’ N	22° 59.90’ W	1302	3865	L	U	P				4			7	8
Station	CTD cast	Date	Time	Latitude	Longitude	max. d [m]	bottom [m]	Additional measurements										
M1060/368-1	050	03.05.14	22:56	00° 09.96’ S	22° 59.77’ W	1302	3860	L	U					4			7	8
M1060/369-2	051	04.05.14	05:46	00° 00.03’ N	23° 00.79’ W	3945	3955	L	U		1	2	3	4		6		8
M1060/371-1	052	04.05.14	14:13	00° 00.02’ N	23° 01.00’ W	596	3950		U	P					5		7	
M1060/371-3	053	04.05.14	17:37	00° 00.01’ N	23° 00.93’ W	3942	3954	L	U									
M1060/372-0	054	04.05.14	22:09	00° 19.97’ S	23° 00.00’ W	52	4616	L										
M1060/372-1	055	04.05.14	22:43	00° 19.97’ S	22° 59.93’ W	4605	4616	L										
M1060/372-3	056	05.05.14	03:30	00° 19.97’ S	22° 59.96’ W	4565	4615	L	U									
M1060/373-1	057	05.05.14	08:21	00° 39.88’ S	23° 00.03’ W	3552	3564	L	U									
M1060/374-1	058	05.05.14	12:58	00° 59.94’ S	22° 59.94’ W	4117	4127	L	U		1	2	3	4			7	
M1060/375-1	059	05.05.14	18:42	01° 19.98’ S	23° 00.00’ W	4839	4849	L	U									
M1060/376-1	060	05.05.14	23:51	01° 39.97’ S	23° 00.03’ W	4913	4925	L	U									
M1060/377-1	061	06.05.14	05:04	01° 59.99’ S	23° 00.03’ W	5209	5218	L	U		1	2	3	4	5		7	
M1060/378-1	062	06.05.14	10:46	02° 19.98’ S	23° 00.02’ W	5118	5127	L	U									
M1060/379-1	063	06.05.14	16:34	02° 40.00’ S	23° 00.03’ W	5622	5632	L	U									
M1060/380-1	064	06.05.14	22:31	03° 00.00’ S	23° 00.11’ W	102	5470		U								7	
M1060/380-3	065	07.05.14	00:41	02° 59.99’ S	23° 00.01’ W	5462	5472		U		1	2	3	4				8
M1060/381-1	066	07.05.14	06:56	03° 19.97’ S	23° 00.04’ W	5170	5180	L	U									
M1060/382-1	067	07.05.14	12:48	03° 39.99’ S	23° 00.02’ W	5325	5334	L	U						5			
M1060/383-1	068	08.05.14	01:00	03° 59.99’ S	23° 00.01’ W	5692	5820	L	U		1	2	3	4				
M1060/384-1	069	08.05.14	08:26	04° 29.99’ S	23° 00.05’ W	5152	5164	L	U									
M1060/385-1	070	08.05.14	15:38	05° 00.00’ S	23° 00.04’ W	5181	5190	L	U		1	2	3	4			7	
M1060/386-1	071	08.05.14	23:20	05° 29.99’ S	23° 00.02’ W	1303	5080	L	U									

Station	CTD cast	Date	Time	Latitude	Longitude	max. d [m]	bottom [m]	Additional measurements										
M1060/387-1	072	09.05.14	03:36	06° 00.00' S	23° 00.02' W	5203	5213	L	U		1	2	3	4				
M1060/388-1	073	09.05.14	10:08	06° 29.99' S	23° 00.03' W	1302	5370	L	U	P								
M1060/389-1	074	09.05.14	14:16	06° 59.97' S	23° 00.01' W	124	5238		U	P							7	
M1060/389-3	075	09.05.14	15:35	06° 59.97' S	23° 00.01' W	5230	5238	L	U		1	2	3	4				8
M1060/390-1	076	09.05.14	22:05	07° 29.99' S	23° 00.02' W	1302	5350	L	U									
M1060/391-1	077	10.05.14	02:21	07° 59.99' S	23° 00.02' W	5567	5577	L	U		1	2	3	4				
M1060/392-1	078	10.05.14	09:22	08° 30.00' S	23° 00.02' W	1297	5750	L	U	P								
M1060/393-2	079	12.05.14	16:46	11° 29.98' S	32° 00.04' W	5019	5029	L	U									
M1060/394-1	080	12.05.14	23:01	11° 29.98' S	32° 27.03' W	4740	4749	L	U								7	
M1060/395-1	081	13.05.14	04:42	11° 29.97' S	32° 53.04' W	3486	3495	L	U									
M1060/396-1	082	13.05.14	08:57	11° 29.97' S	33° 13.03' W	4276	4285		U									
M1060/397-1	083	13.05.14	13:38	11° 29.98' S	33° 33.02' W	4954	4965	L	U				3					
M1060/398-1	084	13.05.14	18:40	11° 29.98' S	33° 53.07' W	4608	4618	L	U									
M1060/403-1	085	14.05.14	16:33	10° 14.57' S	35° 53.59' W	211	223	L	U	P								
M1060/404-1	086	14.05.14	18:13	10° 15.30' S	35° 52.61' W	499	513	L	U	P			3					
M1060/405-1	087	14.05.14	20:51	10° 15.96' S	35° 51.56' W	889	900	L	U	P							7	
M1060/406-1	088	15.05.14	00:16	10° 19.14' S	35° 45.71' W	1747	1760	L	U									
M1060/407-1	089	15.05.14	04:08	10° 22.51' S	35° 40.38' W	2299	2310	L	U									
M1060/410-1	090	15.05.14	17:34	10° 26.97' S	35° 34.66' W	2857	2868	L	U									
M1060/411-1	091	15.05.14	22:07	10° 31.97' S	35° 29.34' W	1052	3200	L	U									
M1060/411-3	092	16.05.14	00:00	10° 32.00' S	35° 29.33' W	3199	3208	L	U									
M1060/412-1	093	16.05.14	04:51	10° 36.43' S	35° 23.59' W	3502	3513	L	U									
M1060/413-1	094	16.05.14	19:47	10° 41.39' S	35° 17.62' W	3658	3675	L	U				3					
M1060/414-1	095	17.05.14	00:11	10° 46.39' S	35° 11.62' W	3849	3870	L	U									
M1060/415-1	096	17.05.14	04:40	10° 51.40' S	35° 05.63' W	3932	3962	L	U									
M1060/416-2	097	17.05.14	12:26	10° 56.39' S	34° 59.61' W	4076	4098	L	U				3					
M1060/417-1	098	17.05.14	23:52	11° 07.59' S	34° 43.91' W	4222	4246	L	U									
M1060/418-1	099	18.05.14	06:20	11° 18.79' S	34° 28.22' W	4601	4636	L	U									
M1060/419-1	100	18.05.14	13:12	11° 29.99' S	34° 13.01' W	4552	4570	L	U									
M1060/420-1	101	19.05.14	01:56	10° 37.07' S	35° 22.81' W	3507	3527	L	U								7	
Station	CTD cast	Date	Time	Latitude	Longitude	max. d [m]	bottom [m]	Additional measurements										
M1060/421-1	102	19.05.14	05:20	10° 31.93' S	35° 29.26' W	3178	3205	L	U									
M1060/422-1	103	21.05.14	02:12	05° 00.01' S	31° 30.02' W	4628	4694	L	U								7	
M1060/423-1	104	21.05.14	10:01	05° 07.02' S	32° 00.03' W	4586	4604	L	U									
M1060/424-1	105	21.05.14	17:23	05° 12.33' S	32° 30.03' W	122	4590		U	P							7	
M1060/424-2	106	21.05.14	18:00	05° 12.31' S	32° 30.02' W	4543	4590	L	U					4				8
M1060/425-1	107	22.05.14	00:17	05° 17.70' S	33° 00.02' W	4533	4557	L	U									
M1060/426-1	108	22.05.14	07:05	05° 21.71' S	33° 25.03' W	4418	4476	L	U				3	4			7	8
M1060/427-1	109	22.05.14	13:53	05° 26.59' S	33° 50.02' W	4230	4318	L	U									
M1060/428-1	110	22.05.14	20:33	05° 30.23' S	34° 10.22' W	119	4112		U								7	
M1060/428-2	111	22.05.14	21:24	05° 30.23' S	34° 10.22' W	4059	4112	L	U					4				8
M1060/429-1	112	23.05.14	03:02	05° 32.51' S	34° 23.97' W	3739	3763	L	U									
M1060/430-1	113	23.05.14	08:59	05° 34.11' S	34° 35.73' W	3403	3407	L	U									
M1060/431-1	114	23.05.14	13:48	05° 35.60' S	34° 46.15' W	2702	2837	L	U					4				8
M1060/432-1	115	23.05.14	17:56	05° 37.35' S	34° 54.00' W	1471	1654	L	U				3					
M1060/432-3	116	23.05.14	21:29	05° 37.63' S	34° 54.03' W	600	1500	L	U						5			
M1060/433-1	117	23.05.14	22:54	05° 38.05' S	34° 55.89' W	683	700	L	U					4	5			8
M1060/434-1	118	24.05.14	01:10	05° 38.86' S	34° 57.67' W	281	300		U					4	5			8

Explanation of additional measurements of CTD station list

L	LADCP
U	UVP
P	PAR
1	POC/PON
2	POP
3	Chlorophyll a
4	Nutrients
5	Rare earths
6	DNA
7	N_2 fixation
8	N_2O

7.4 MSS station list

Station	MSS-Station	Date	Time	Latitude	Longitude	max. d [m]	bottom [m]	Profile numbers
M1060/324-3	01	20.04.14	21:10 - 22:40	17° 35.12' N	24° 14.36' W	480	3590	1, 2, 3
M1060/337-5	02	25.04.14	01:30 - 04:10	11° 02.18' N	21° 13.41' W	850	5070	5, 6, 7
M1060/337-6	03	25.04.14	04:35 - 07:30	11° 02.57' N	21° 13.41' W	750	5070	8, 9, 10, 11
M1060/346-1	04	27.04.14	21:00 - 00:35	06° 23.46' N	22° 54.87' W	720	1350 to 1800 to 1550	12, 13, 14, 15, 16
M1060/352-1	05	29.04.14	03:30 - 06:30	04° 59.01' N	22° 59.00' W	970	4190	17, 18, 19, 20
M1060/353-1	06	30.04.14	07:00 - 08:40	04° 31.17' N	22° 25.86' W	730	3650	21, 22
M1060/366-1	07	03.05.14	07:40 - 08:40	00° 00.12' N	23° 06.01' W	270	3930	23, 24, 25
M1060/367-3	08	03.05.14	19:40 - 20:45	00° 09.99' N	22° 59.82' W	290	3870	26, 27, 28
M1060/368-3	09	04.05.14	01:35 - 03:30	00° 09.95' S	22° 59.14' W	500	3950	29, 30, 31
M1060/371-2	10	04.05.14	16:15 - 17:05	00° 00.35' N	22° 58.79' W	270	3960	32, 33, 34
M1060/372-2	11	05.05.14	01:35 - 03:10	00° 20.03' S	22° 59.87' W	480	4620	35, 36, 37
M1060/403-2	12	14.05.14	17:00 - 17:55	10° 14.63' S	35° 53.58' W	250	230 to 300	38, 39, 40, 41
Station	MSS-Station	Date	Time	Latitude	Longitude	max. d [m]	bottom [m]	Profile numbers
M1060/404-2	13	14.05.14	18:45 - 20:30	10° 15.37' S	35° 52.42' W	450	580 to 720	42, 43, 44
M1060/405-2	14	14.05.14	21:35 - 23:15	10° 15.99' S	35° 51.33' W	410	960 to 1000	45, 46, 47
M1060/406-2	15	15.05.14	01:50 - 03:25	10° 18.82' S	35° 45.16' W	390	1840	48, 49, 50
M1060/407-2	16	15.05.14	05:35 - 08:20	10° 22.30' S	35° 39.92' W	400	2350	51, 52, 53, 54, 55
M1060/410-2	17	15.05.14	19:25 - 21:15	10° 26.79' S	35° 34.45' W	490	2870	56, 57, 58
M1060/411-2	18	15.05.14	23:05 - 23:45	10° 31.89' S	35° 29.31' W	440	3200	59
M1060/411-4	19	16.05.14	02:40 - 04:05	10° 31.95' S	35° 29.31' W	470	3210	60, 61, 62
M1060/412-2	20	16.05.14	07:15 - 09:00	10° 36.59' S	35° 23.22' W	490	3520	63, 64, 65
M1060/413-2	21	16.05.14	22:05 - 23:15	10° 41.42' S	35° 17.55' W	510	3670 to 3780	66, 67
M1060/414-2	22	17.05.14	02:30 - 03:45	10° 46.47' S	35° 11.50' W	530	3870	68, 69
M1060/415-2	23	17.05.14	07:00 - 08:25	10° 51.45' S	35° 05.54' W	590	3960	70, 71
M1060/416-2	24	17.05.14	20:00 - 21:40	10° 55.92' S	34° 59.77' W	550	4100	72, 73, 74
M1060/417-2	25	18.05.14	02:35 - 04:15	11° 07.63' S	34° 43.85' W	580	4230	75, 76 ,77
M1060/418-2	26	18.05.14	09:15 - 11:05	11° 18.83' S	34° 28.17' W	550	4620	78, 79, 80
M1060/419-2	27	18.05.14	16:15 - 17:45	11° 30.03' S	34° 12.98' W	550	4560	81, 82, 83
M1060/422-2	28	21.05.14	05:20 - 07:00	04° 59.92' S	31° 30.01' W	630	4690	84, 85, 86
M1060/423-2	29	21.05.14	12:45 - 14:25	05° 07.00' S	31° 59.96' W	550	4590	87, 88, 89
M1060/424-3	30	21.05.14	20:45 - 21:10	05° 12.29' S	32° 29.96' W	250	4580	90
M1060/425-2	31	22.05.14	03:05 - 04:20	05° 17.70' S	33° 59.99' W	350	4540	91, 92, 93
M1060/426-2	32	22.05.14	09:45 - 11:25	05° 21.83' S	33° 25.04' W	410	4460	94, 95, 96
M1060/427-2	33	22.05.14	16:20 - 18:05	05° 26.61' S	33° 49.98' W	530	4300	97, 98, 99, 100
M1060/428-3	34	22.05.14	23:50 - 01:30	05° 30.24' S	34° 10.17' W	460	4100	101, 102, 103
M1060/429-2	35	23.05.14	06:00 - 07:40	05° 32.21' S	34° 23.88' W	420	3760	104, 105, 106
M1060/430-2	36	23.05.14	11:05 - 12:40	05° 33.77' S	34° 35.55' W	400	3430	107, 108, 109
M1060/431-2	37	23.05.14	15:35 - 17:00	05° 34.78' S	34° 46.14' W	430	2570 to 2370	110, 111, 112
M1060/432-2	38	23.05.14	19:00 - 20:50	05° 36.68' S	34° 53.99' W	430	1290 to 780	113, 114, 115
M1060/433-2	39	23.05.14	23:40 - 00:35	05° 37.66' S	34° 55.73' W	150	700	probe failure
M1060/434-2	40	24.05.14	02:35 - 03:20	05° 38.97' S	34° 57.62' W	300	420 to 180	120, 121, 122

8 Data and Sample Storage and Availability

In Kiel, a joint data management team is set up to store the data from various projects and cruises in a web-based multi-user-system. Data gathered during M106 are stored at the Kiel data portal, and remain proprietary for the PIs of the cruise and for members of SFB754. Each station is logged as an event file (https://portal.geomar.de/metadata/leg/show/322815). All data will be submitted to PANGAEA within 3 years, i.e. by April 2017. Preliminary CTD data were submitted to CORIOLIS during the cruise for real time oceanographic analysis and Argo calibration.

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Tab. 8.1 Overview of contact persons for the different data sets.

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10 References

During the cruise we followed the guidelines recently developed by the GO-SHIP group, particularly did we consider the guides for best practices:

Hood, E.M., C.L. Sabine, and B.M. Sloyan, eds. 2010. The GO-SHIP Repeat Hydrography Manual: A Collection of Expert Reports and Guidelines. IOCCP Report Number 14, ICPO Publication Series Number 134. Available online at http://www.go-ship.org/HydroMan.html

Langdon, C., 2010. Determination of Dissolved Oxygen in Seawater by Winkler Titration Using the Amperometric Technique, edited by M. Hood IOCCP report.

Dickson AG, Sabine CL, Christian JR (Eds.), 2007. Guide to Best Practices for Ocean CO2 Measurements. PICES Special Publication 3.

Pierrot, D. et al., 2009. Recommendations for autonomous underway pCO$_2$ measuring systems and data-reduction routines. Deep-Sea Research II 56, 512-522.

Specific sections referred to:

M. Dengler, F. Schott, C. Eden, P. Brandt, J. Fischer, R. J. Zantopp, 2004. Break-up of the Atlantic Deep Western Boundary Current into eddies at 8°S, Nature, 432, 1018-1020.

Martínez-García S, Fernández E, Aranguren-Gassis M, Teira E, 2009. In vivo electron transport system activity: a method to estimate respiration in natural marine microbial planktonic communities. Limnol Oceanogr Methods 7:459-469

Pierrot, D. et al., 2009. Recommendations for autonomous underway pCO$_2$ measuring systems and data-reduction routines. Deep-Sea Research II 56, 512-522.